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Electronics Today International

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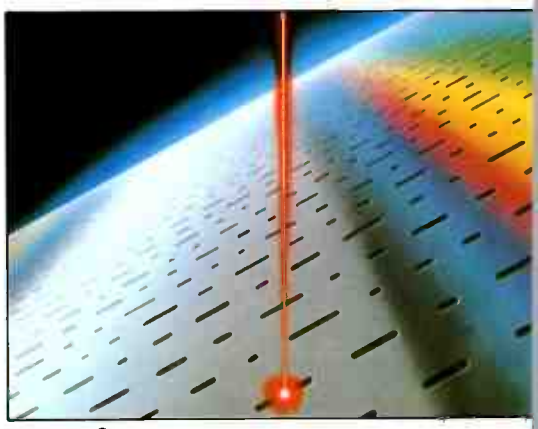

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SOUND INSIGHTS

COVER: Courtesy Fairlight Instruments

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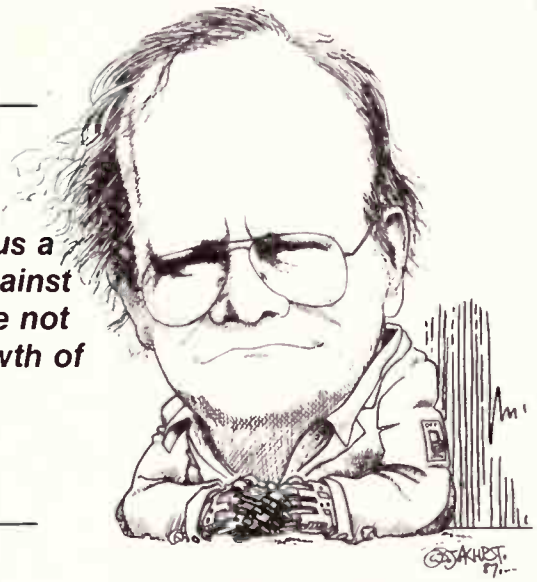
Frequency

> ***It could also afford us a level of protection against violent crime we have not enjoyed since the growth of large cities.***



The Australia card has finally been laid to rest, but like Hamlet's ghost, its spectre will continue to haunt us for while yet. This is a function of the way in which the Card's opponents managed to use a legal technicality to thwart the wishes of the government. Undoubtedly it was a move that embarrased the government. It may even have enhanced the public perception of the opposition, but it did nothing to enhance the debate concerning the technological problems that underpinned the whole Australia Card debacle.

Nothing can illustrate this better than the latest moves in Canberra, where the government is calling for a link between Police, Tax Office and bank computers in an effort to stamp out tax evasion. Mr Wilson Tuckey, the opposition spokesman on the ID card, has called it "the back door ID card". He is quite correct.

The technology at issue, of course, is data communications; the alliance of computers with communications technology that allows information on a data base to be transfered from the computer where it was created to the computer where it is needed. Readers of this magazine will by and large be familiar with the idea, and its potential, but it is only now that the broad social implications are starting to seep through to the wider community.

As a contribution to this debate, I offer three thoughts. One is that data communications is here to stay. The impact on our society of optical fibre and satellite communications links is only now beginning to be felt. But within our current planning horizons we will see a time when the cost of transfering data will be insignificant next to the other costs associated with setting up an information network.

There are a couple of engines driving this along. One is the amount of money to be made by both providers and consumers of the various communications services. This alone will ensure that there is plenty of pressure to expand services even more. The other is that information is power, and the increase of power in the *sine qua non* of bureauracies.

The second thought is that the presence of very large scale data distribution in the hands of the controllers of our society has the potential to do as much good as evil. On the positive side, it could make large scale financial fraud a thing of the past, by matching bank accounts and other transactions against known earning capacity for every individual in the country. It could also offer us a level of protection against violent crime we have not enjoyed since the growth of large cities.

Continued

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Chapter 3 considers ways of testing the more common components such as resistors, capacitors, op amps, diodes, transistors, SCRs, unijunctions, etc., with the aid of only a limited amount of test equipment.
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ETI NOV '87

Administered carelessly, it could cause massive injustice and, even worse, destroy the spark of individuality and creativity that has been responsible for so much that is praiseworthy in Western Civilisation.

The third point, and it may well be the most significant of all, is that privacy legislation is now of paramount concern. Indeed, the difference between using data communications well, and using it badly, might be just a question of the control that private individuals have over the contents of the data bases.

We must have a privacy bill with teeth. At an absolute minimum, it must acknowledge the right of any citizen to completely free and unfettered inspection of any information held about that citizen on any data base. There must be mechanisms for changing the information, and an independent panel to hear disputes. It will not do for the public service to say that the costs associated with this type of access are not worth the benefits. They are, but interestingly, the costs may well be imaginary, since the very technologies that make privacy an issue in the first place will also help to disseminate information cheaply to the right people.

Access is important for two reasons. One is the immensely practical reason that it helps if the information on date bases is correct. But more importantly, the horror that many people feel at the prospect of unlimited computerised intrusion is founded on fear of the unknown, the feeling of complete powerlessness that one must feel confronted with an ominpotent bureaucracy.

It is essential, if we are to have a vigorous and creative society, that power is shared as equally as possible. Data communications technology can be used to centralise or disperse power and decision making. We must ensure that the latter takes place.

— Jon Fairall

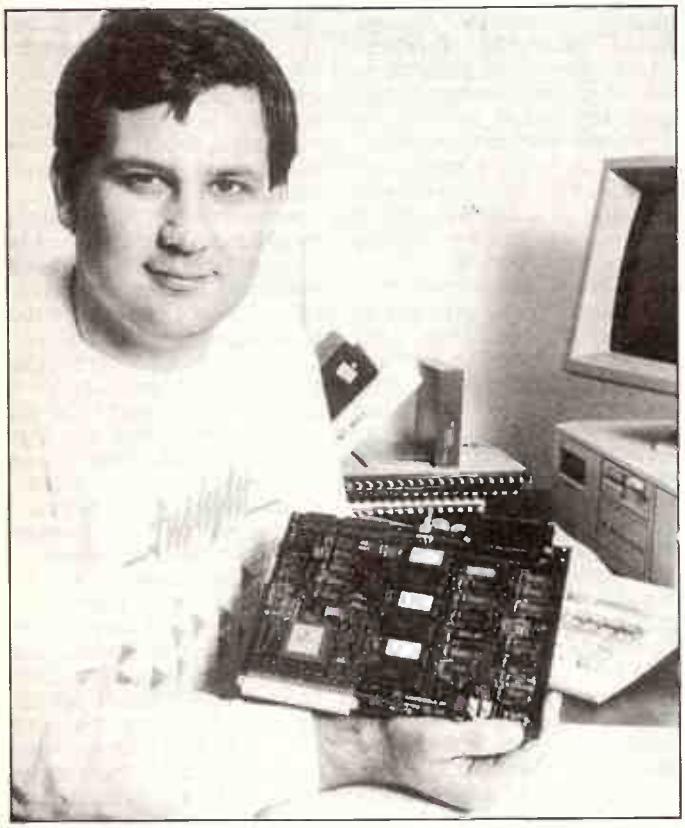
NEWS DIGEST

Fairlight Looks To The Future

Fairlight Instruments, the Sydney based music equipment maker, has just completed restructuring to improve its position and to allow it to be a leader in next generation music technology.

The first move has been a substantial capital injection by the addition of two new venture capital partners. There has also been a reorganization of the vital US corporation Fairlight Inc. Fairlight Inc was founded in 1983 as a partnership between Fairlight and George Hormel Enterprises. Now Fairlight has acquired a controlling interest in the US company, which will function as a subsidiary of the Fairlight Australia.

Fairlight itself was originally set up in 1975 by Kim Ryrie and Peter Vogel with a view to creating a music synthesiser. (Ryrie was instrumental in setting up ETI in 1971.) In 1979 they delivered the fruits of their labour, the Computer Musical Instrument. It had the capacity to sample sounds which could then be played in normal pitch on the keyboard, and became indispensible to musicians like Stevie Wonder and Peter Gabriel.



Michael Topic

The company has grown to the extent that it now employs 90 people, around a third of them in research and development. Apart from ongoing software development to both the music and video instruments, Fairlight is engaged heavily in assessing technology for the next generation computer instruments that will use digital processing throughout. Currently, Fairlight is one of the few companies world wide in possession of Motorola's Digital Signal Processing prototype DSP56000 chip.

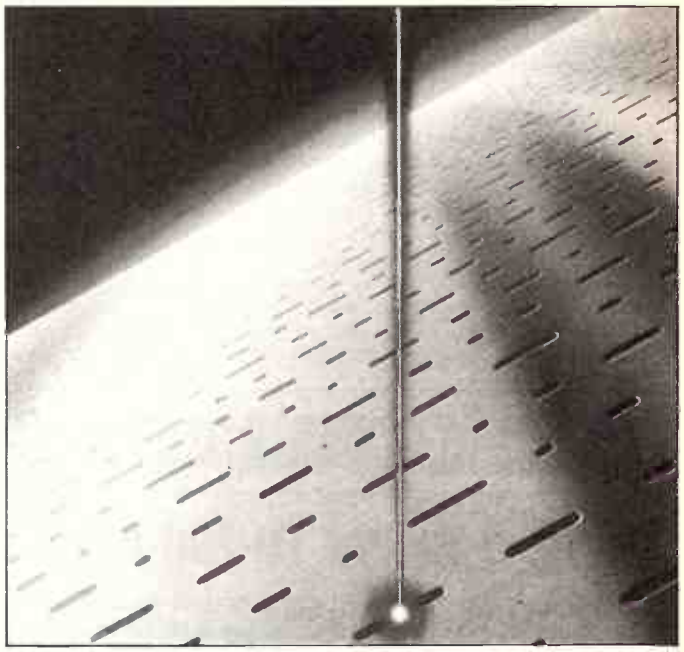
The DSP56000 operates at 10.25 Megs, and Fairlight engineer Michael Topic says it should theoretically "be perfect for audio applications". It has a 24 x 24 bit multiplyer which accummulates to 56 bit results. This combination of speed and accuracy makes it possible to do highly accurate sampling in real time.

Current generation Fairlights use a mixture of analogue and digital circuitry. The analogue part of the circuit is preserved because no existing digital techniques provide professional noise levels or dynamic ranges in real time at the right price. The hope is that DSP56000 type devices might make this possible within the next few years. It is unlikely, however, that any commercial product will see the light of day as a result of this ic.

Topic says the chip has a number of bugs, which one would expect because it's a prototype. "Motorola warned us about some of them, and we are discovering others." Overall, though, results are promising. The other thing going against the DSP56000 at the moment is its price: $700.

However, speculation is that the price will ramp down dramatically during the next few years. Many ic vendors are rushing to develop DSP products and market pressures will force them down. Although they are a novelty item at the moment, Topic says because of their flexibility they will be used in virtually all electronic music devices, and in fact will be mass market devices before long.

NEWS DIGEST



Laser Futures

The laser industry will soon be transformed by specialisation, mergers, acquisitions, and bankruptcies, according to a new 188-page research report from the US-based research company International Resource Development. When this transformation is all over, reveals the report, the victors will be the large electronics companies.

Most of today's laser companies are small, often with revenue of under $10 million, and several have a shabby history of profitability.

IRD predicts the laser companies will have to specialise to survive. The study claims that it has become increasingly difficult for laser companies to give sufficient marketing attention to more than a few applications areas. But as laser companies start to specialise in one or two applications areas, the distinction between the "product laser market" and the "laser system market" will become increasingly fuzzy. Specifically, IRD's team feels that the growing standardisation of product lasers will force product laser makers to add value by moving into the systems markets, where they can more easily distinguish their products. This will led to more downstream integration in the laser industry, because many of the non-laser companies that use lasers in their products will attempt to safeguard and control the supply of vital components by buying into a laser company. In fact, the principal market for lasers are the giants of the electronics and telecommunications industries. The temptation to buy out the small companies will be enormous.

In addition, the greater marketing and distribution resources available to large non-laser based companies will represent a serious threat to independent laser makers. Once the larger companies have begun production of product lasers and laser systems for their own use, they will easily be able to expand beyond the original scope of their production. If the larger company foresees a profitable opportunity, it has the resources to enter a new applications market.

The IRD report predicts that smaller laser companies that can neither find a niche market, nor a purchaser, will disappear. Thus, by the early 1990s, there will be far fewer laser companies than at present, but far bigger and probably healthier ones.

Satellite Radiopaging Trials

British Telecom International (BTI), Britain's principal telecommunications company, will launch trials of the world's first satellite radiopaging service at the end of this year.

It will provide radio links between British road haulage firms and their long-distance truck drivers en route across Europe, the Middle East and Africa. The system was developed by research engineers at British Telecom International.

The announcement of trials for this facility coincided with the 25th anniversary of satellite communications.

Messages sent by the international radiopagers will be transmitted via BTI's satellite earth station at Goonhilly Downs in south west England, to an Inmarsat satellite. The signal will be delivered to a small purpose-built antenna mounted on the roof of the cab and linked to a pager and printer situated on the parcel shelf.

Falling Behind In France

The French government is worried that France is falling behind in the race for new technologies. Last year there were 60,000 patents in the US, 30,000 in West Germany, 20,000 in the UK but only 12,000 in France.

The French Prime Minister, Jacques Chirac has announced new measures to redress the problem. They range from tax incentives for R and D in the private sector, to financial rewards to scientists who leave the government research bodies to work in industry.

The problem, according to the government, is that the large state supported research bodies cream off the best scientists and then show little interest in turning out marketable products. Chirac has ordered that this barrier between public and private industry must be broken down. He has set up a "New Materials" programme to link defence, industry, communications, the Atomic Energy Commission and Research Organisations. The Programme has a budget of FF 200m.

Siromath

Professor David J. Newell, Emeritus Professor of Medical Statistics at the University of Newcastle-upon-Tyne, has joined the statistical consulting organisation, SIROMATH, the first of CSIRO's private sector initiatives which has provided a continuously increasing cunsulting and research service to business, industry and government since 1981.

He is well known for his work in clinical trials and health studies in England and Europe, and also for his research into management aspects of the health care system. He will lead the Melbourne office of SIROMATH, which currently specialises in survey work (especially in the health area), and industrial and management statistics with particular emphasis on Total Quality Control systems.

In Search Of Humphrey

Bob Harrington of the US Naval Observatory knows what no one else does — the location of Planet 10; the missing planet which lies beyond the edge of the known solar system. He has set up his telescope in New Zealand, and reguarly examines photographs from it in an attempt to find immortality as the discoverer of the mysterious planet he calls Humphrey.

The search for Humphrey has been on since early last century. It started because of irregularities in the orbit of the outermost known planet, Uranus, and led to the discovery of Neptune in 1846. However, when the new planet's orbit was followed over the next 50 years, it became apparent that there was still a residual influence. It was popularly supposed that these irregularities were the gravitational evidence for another planet. This view was confirmed by the discovery of Pluto in the 1930s.

However, subsequent work has proven the matters are not quite so simple. We now know that Pluto is not quite what we once supposed. It is, in fact, two bodies in very close orbit (the other is called Charon) and both are tiny, asteroid sized rocks, quite incapable of preturbing gas giants like Neptune and Uranus. Furthermore, the irregularity in the orbits of Uranus and Neptune disappeared as the century wore on, so there was a move to write off the earlier findings as a case of badly calibrated telescopes, and the discovery of Pluto as a fantastic bit of luck.

These ideas have been put to the test by two small gravitational probes now flying through the outer reaches of the solar system. Pioneer 10 and 11 have both reached the edge. Pioneer 10 is actually beyond the orbit of Pluto, thus officially in interstellar space, while Pioneer 11, launched in 1973, is still inside Neptune's orbit.

Both probes have radio transmitters on board transmitting a carrier wave with a highly stable frequency. Current equipment can use the doppler shift of this signal to indicate variations in speed of 1 mm per second, even though both probes are now exiting the solar system at over 14 km per second. In effect, they have become super sensitive probes of the gravitational field beyond the planets.

John Anderson, of NASAs Jet Propulsion Laboratory, began studying the course of the Pioneers about five years ago in order to see if there were any leads to the position of Humphrey. So far, according to Anderson, the results have been entirely negative. However, even a negative result helps, since it puts limits of the possible size and position of a further planet, if it exists.

We now know for sure that it is not a distant, dim companion star, or a huge gas bag like Jupiter. In fact there can be no more than five earth masses located anywhere beyond Pluto that affect the solar system. This is interesting in itself because it limits the number of comets circling the sun at these great distances.

Harrington has an answer for this. He believes that Humphrey is on a highly inclined and eliptical orbit. It weighs no more than five to eight times the earth and orbits about once every 800 years. Re-analysis of the data on the orbits of Neptune and Uranus shows that they were peturbed only between 1810 and 1910, so it is a safe bet that Humphrey was then close enough to affect the other planets measurably, but is now so far away that it cannot do so.

According to Harrington, Humphrey is now well south of the plane of the other planets, hence his New Zealand location. It is still heading away from us. He is hoping that it will still be bright enough to be visible from his telescope, because if it isn't we may well have to wait until it comes back again, around 2650, to get a good look at it.

Technology Award Scheme

Texas Instruments Australia has launched a $100,000 sponsorship of a national Technology Award scheme initiated to promote research into advanced micro electronics.

The award scheme, open to all final year electrical engineering students at universities, institutes, and colleges of advanced education throughout Australia, has been initiated for the 1987 academic year.

Students have been invited to submit research projects in the areas of:

- Digital Signal Processing
- Local Area Networks
- Parallel Processing

To ensure these young researchers have access to the latest in semiconductor technology, Texas Instruments has made a range of chips, development systems, and associated technical documentation available free of charge to the participating institutions.

In 1987, Texas Instruments has supported a total of 30 projects, 10 in each of the categories.

Announcing the awards, Texas Instruments' Marketing Manager for the Semiconductor Division, Mr John Robinson, said:

"Without access to state-of-the-art chips these student projects would not be exploring the full capabilities of the semiconductor product families used by industry.

"We feel very strongly that students should be able to use the latest technology in their prototype designs without being hampered by the expense of the materials involved.

"We know that tertiary institution's research budgets are under extreme pressure as a result of recent Federal funding cuts.

"At TI we thought we could best address this dilemma by supplying electrical engineering students with the latest from TI.

"By stepping in with direct sponsorship, Texas Instruments can insure that electrical engineering students are working with the latest, most comprehensive semiconductor product families," Mr Robinson said.

The sponsorship from Texas Instruments Semiconductor Division is only a part of the company's initiatives in the field of technology transfer.

TI recently sponsored Macquarie University's summer school on Artificial Intelligence and Cognitive Science for final year HSC students, and has initiated a work experience program for tertiary engineering students.

Further information may be obtained from Texas Instruments Australia, Semiconductor Group, (02) 887-1222. Descriptions of the most interesting projects will be carried in ETI during 1988.

SciRaD

A Queensland company, SciRaD, has acquired 75% of the shares in an X ray laser company that is developing technologies which will have a profound impact on microscopy, medical scanning and lithography.

A SciRad spokesman said that the company had entered into an agreement with Princeton Soft X-Ray Laser (PXL) of New Jersey, USA, to commercialize soft X-ray laser technology developed by Dr Szymon Suckewer at Princeton University.

PXL is owned by the family of Dr Szymon Suckewer, who heads the Princeton soft X-ray programme. It has the exclusive rights from Princeton to commercialize the technology throughout the world. SciRaD's agreement with PXL provides for it to earn up to a 75% equity in PXL through the commercialization of the laser.

SciRaD will also invest in final stage R&D of the technology, which will be carried out in Australia and includes commercial prototype development. A team of Australian researchers and development engineers will be established for this purpose. Basic research however will continue to be financed and carried out by Dr Suckewer and his team at Princeton University.

In 1976 Suckewer conceived the idea of using an infrared (CO^2) laser to produce a fast-recombining plasma, confined by a magnetic field. He theorized that such a plasma could serve as a medium in which X-ray lasing action would occur.

A 1-kJ CO^2 laser pulse is focused onto a solid carbon disc as a ~ 200 x 400 μm elliptical spot. The pulse energy is variable (from 0.1-1.0 kJ), with a maximum powder density on target of about $2 \times 2 \times 10^{13}$ W/cm^2. The target chamber is situated along the axis of a 1-m long solenoidal magnet, normally operated below 100 kG auss.

When the laser strikes the target, a dense carbon plasma column of 1-2 cm in length is produced. The column is held to a 1-2-mm diameter by a strong magnet field which radially confines the plasma but allows free axial expansion. The plasma temperature rapidly increases to a point at which the carbon atoms become completely ionized. The plasma is then allowed to cool rapidly by intensive radiation losses, causing ions to recombine with free electrons. Because recombination occurs primarily on the higher energy levels (outer orbits) while lower levels (inner orbits) do not capture electrons, an unstable condition known as "population inversion" occurs. Electrons in the higher energy levels then avalanche to the lower levels to bring about a more stable electron configuration. In the process, each electron loses energy in the form of a photon of X-ray light. The lasing process occurs when the photons produced in this fashion stimulate the emission of additional photons from other ions, initiating a chain of such events. The result is an intense, soft X-ray pulse of a single wavelength.

An upgrade has been the addition of an XUV mirror with 12% reflectivity in the X-ray region. The mirror was placed on-axis to enhance amplification by reflecting X-ray photons back into the plasma to stimulate additional emissions. Intial experiences with an XUV mirror demonstrated a 120% increase in the intensity of the stimulated emission. Enhancement of this effect will be obtained in the future through improved alignment techniques and development of an X-ray laser cavity to effect multiple reflections.

The group's near-term goal is to increase gain still more by increasing the effective length of the plasma column and installing a state of the art, multilayered XUV mirror. While work on this original experiment is still ongoing, a new idea which will use multiphoton processes to generate X-ray lasing action at much shorter wavelengths (and, therefore, higher energies) has been proposed.

Left: Szymon Suckewer with Alan Melcalfe of SciRad at the signing of the agreement.

Scientists envision a multitude of applications for X-ray lasers in a variety of fields including physics, electronics, biochemistry, and medicine.

Medical applications are perhaps of the broadest interest, especially diagnostics. The finely focused X-ray laser would allow a much higher degree of localization in the use of CAT scanners, thereby lowering patient exposure considerably. The higher resolution afforded by the laser would provide greater detail of the subject.

Closely related are many biological applications including the ability to make 3-dimensional pictures of molecular structures such as DNA. X-ray lasers would allow biological structures to be viewed in detail in their natural environments, since specimens would not require special (usually destructive) preparation as in electron microscopy.

In the field of electronics, X-ray lasers might be used in photolithography to "print" complex integrated circuit patterns onto semiconductors, allowing even greater miniaturization for a myriad of electronic devices ranging from satellite components to television sets.

Finally, but not at least importance, are a host of apparent applications in physics and chemical research. Plasma physicists would use X-ray lasers in measurements of temperature, impurity densities, and ion transport. In the area of solid-state physics, X-ray lasers would allow a substantial improvement in the ability to analyze the structure of crystalline solids and surfaces. Advances in the use of spectroscopy for chemical analysis would also be possible utilizing the X-ray laser's inherent brightness and narrow energy linewidth. These features might lead to more precise instrument calibration through the ability to stimulate a few select atomic transitions. Because of the speed with which X-ray lasers operate, chemists could be given the opportunity to analyze short-lived chemical intermediates.

SciRaD is now seeking a suitable site in Australia to conduct complementary research and development into commercial applications of soft X-ray laser technology. SciRaD is interviewing universities and similar established R&D institutions about accommodating the project.

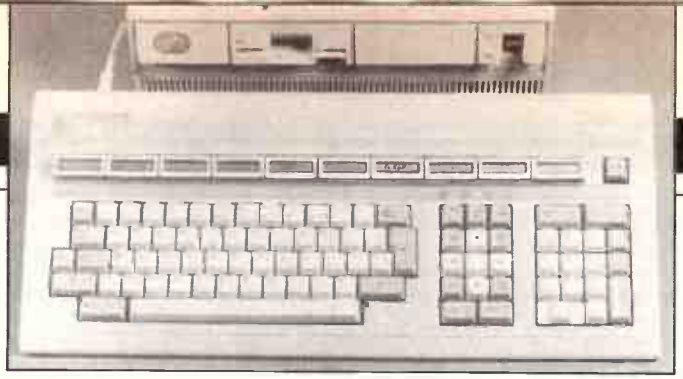
SciRaD now wants to integrate the PXC technology with SciRaD's parallel interest in medical diagnostics. In particular it was examining opportunities to utilize the potential of SXL technology with NMR Spectroscopy developed by Professor David Doddrell at the University of Queensland. Both technologies offer considerable promise for cancer research.

LCD Keys

Most market analysts are agreed that if computers are to penetrate further into the community than they do today then the design of computers must make them easier to use, less threatening and more intuitive. There have been a number of attempts in this region. The mouse, touch tablets, touch screens and joysticks are typical examples.

The problem is that these work well with graphics type software. They are of less use with text orientated programmes like word processors and spreadsheets. A Newcastle engineer has developed a solution that goes some way towards solving this problem. It's called the keymaster, and replaces the function keys on a standard pc keyboard with keys with LCDs inbedded in them.

The LCD's are controlled by "keytables", which can be driven from within an applications programme. These tie a particular label displayed on the LCD keys to a sequence of keystrokes within the programme. So, for instance, when the machine powers up, one could arrange things so that the application programmes are listed on the keys. Hitting the relevant key takes you straight to the opening page of the programme. The opening menu options are now displayed on the keys. Once again, operating the relevant one performs the desired task in the programme, and the labels on the keys can once again be changed to list all the operating instructions relevant to that particular part of the programme.



Key Corps new keymaster pc keyboard

According to Marketing Manager David Ballantyne, the LCD keys can perform a vital role in staff training. Once an operator has been trained in the fundamentals of the programme, the provision of clearly labelled keys makes subsequent operation quite simple.

Woods developed the early prototypes of the device working in his backyard. He then secured a patent on the device and went looking for money to exploit it. He found support in John Cannane's Ausminco, who backed the device heavily. The NSW state government also put $300,000 into it.

The result was that the working prototype was replaced by a pc style keyboard with the LCD keys situated in a row across the top. An extension keypad is also available.

According to Ballantyne, the decision to begin with a PC compatible version was more by accident than design. He forsees heavy demand for the technology in many industrial situations where unskilled workers are more and more expected to operate complex controllers.

Keycorp, the company set up to manufacture the keys, was floated on the second board of the Sydney Stock Exchange in October, and expects to begin delivering product in the new year.

Aussat K3

With a groan and a roar Ariane mission V19 blasted protestingly upward from the launch site at Kourou in French Guiana on October 16. On board: the final first generation satellite of the Aussat K series, K3, and a European communiications satellite. The launch signalled that the Western world is now back in the space race with a vengeance after over a year during which the only serviceable rockets belonged to China or the Soviet Union.

The last Ariane launch was destroyed by the mission safety officer after the failure of the third stage rocket motor. For the past year Ariane officials have been trying to determine the exact sequence of events that led to the failure and designing a replacement stage. On the basis of the V19 launch it appears they were successful.

Even so, the launch was not without its heart stopping moments. Sensors on a fuel line to the third stage indicated the line wasn't sealing properly. The countdown was stopped while the problem

COMING EVENTS

OCTOBER

Industrial Vision by Computer is the name given to a seminar organised by the French-Singapore Institute. It will take place over October 26-30 in Singapore. The seminar is designed to examine most factors concerning Factory automation. For more information contact the French Singapore Institute, 12 Science Centre Road, Jurong, Singapore 2260, tel 56-1140.

NOVEMBER

Intofex '87, the computer and communications exhibition for government, will be held in Canberra on November 3-5. Phone (02) 959-5555.

Technology Training Corp is hosting a two day seminar on The New Engineering Manager, in Sydney November 3-4 at Noah's Northside Gardens and Melbourne, November 5-6 at the Hilton International. The guest speaker will be Dr Hans Thamhain. Contact (02) 959-4229.

AI'87 the Australian Joint Artificial Intelligence conference will be held at the Masonic Centre Sydney over November 2-4. Phone (02) 439-5133 for more information.

Small Business Trade Fair will take place over November 5-8 at Centrepoint in Sydney. For more details ring (02) 669-2411.

The International Robot Show is scheduled from November 7-10 at Sydney Centrepoint. Sponsored by the Australian Robot Association the show will display and explain the many functions of modern robots. Australian Exhibition Services Pty Ltd, Illoura Plaza, 424 St Kilda Road, Melbourne, Vic 3004.

CommuniTech and Computer '87 is on in Kuala Lumpur, November 11-14. Contact Australian Exhibition Services on (03) 267-4500.

The Gold Coast Amateur Radio and Hobbies Festival will be held on November 14 at the Albert Waterways Complex, Hooker Boulevardes, Broadbeach, Surfers Paradise. For further details phone (075) 58-2293.

Globecom '87 — Global Communications Conference will be held in Tokyo Japan, November 15-18. For more information contact Miyakawa, Department of Electrical Engineering, Faculty of Engineering, University of Tokyo, 7-3-1- Hongo, Bunkyo-ku, Tokyo 113, Japan. Phone 81-211, ext 6654.

FinnTec 87. The Helsinki International Technical Fair will be held in the Helsinki Fair Centre over November 17-21. For more information ring the Finnish Fair Corporation, PB 21, 00521 Helsinki, tel (9) 0-15 091.

The First International Pacific Air and Space Technology Conference will be held in Melbourne over November 12-17. The Conference is being sponsored by the North American and Australasian Societies of Automotive Engineers with the theme "The Global Challenge in Air and Space". Please contact Mrs Jill Atkinson Melbourne, (03)

was investigated. Subsequent testing proved it was a sensor malfunction so the count down was resumed. Eventually V19 lifted off one hour 45 minutes late and only 1 minute 47 seconds before the launch window closed.

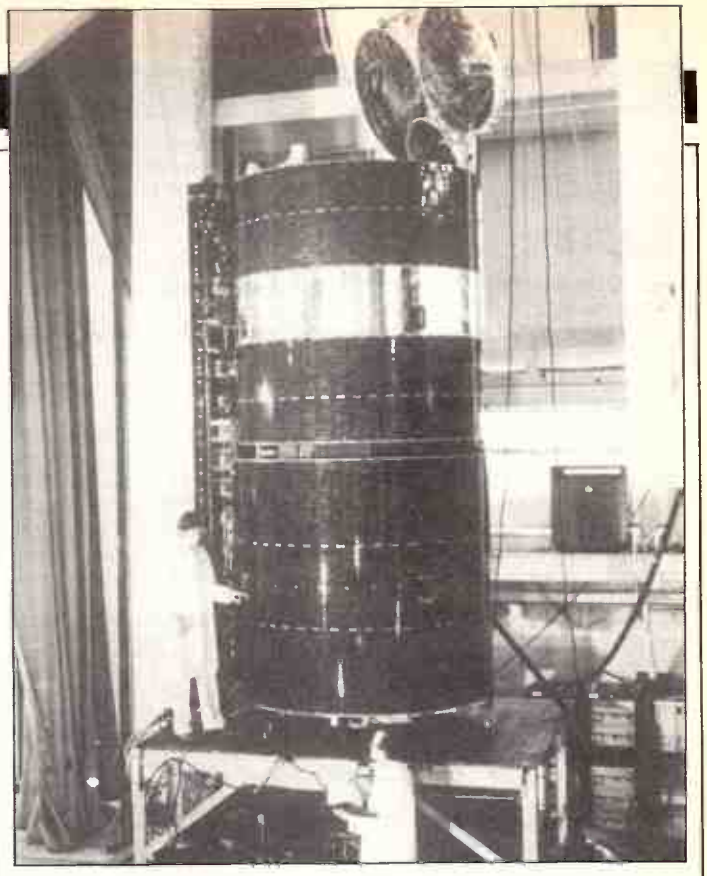
The results were close to perfect. When the third stage finally shut down Ariane was within two kilometres of its intended position and in precisely the correct attitude.

Soon after separation of the satellites from the upper stage casing the satellite became visible to the Aussat Earth station at Lockridge in Perth, and subsequently to the main control centre at Belrose in Sydney, and waiting controllers began the long job of gently coaxing K3 into the geostationary orbit where it will spend the seven years of its working life.

This is a surprisingly complex task. The satellite is spun up to 10 rpm by the final stage, and a small telemetry antenna erected so that it can receive commands from the ground. An explosive charge pushes it away from the spent upper stage. This is the status in which Aussat receives it. An initial task is to increase the spin rate to 50 rpm, followed by orienting the spin axis in space so as to get the thing pointing in the right direction.

During the next two orbits, the satellite is monitored constantly, so that accurate orbital data can be obtained. On the basis of this the on board motors are fired to put it into a perfect transfer orbit. About 22 hours after lift off the motors are fired for the last time to put the satellite into a circular orbit 36,000 km above the surface, where its orbital period is about 24 hours. A further series of corrections to speed and altitude are then necessary. Finally the satellite is orientated southwards, the communications antenna section is despun, the main antenna erected to look down at Belrose and the solar panels extended to provide power.

According to Aussat spokesman Layton Farrell, K3 was functioning perfectly after its launch. It's primary purpose is to provide services into New Zealand and the small island nations of the Pacific. NZ operation of the satellite will essentially mirror Australian requirements: mostly data traffic, with a certain amount of broadcasting reticulation. The extra capacity appears to be surplus to Australian requirements, with only 80 per cent of capacity on the first two satellites so far contracted out.



Final checks on K3

Meanwhile, Aussat has begun the final process of choosing a tenderer for the design and construction of its next generation of satellites. It is expected there will be only two of them, but they will be considerably more powerful. The first is likely to be launched around 1992.

654-7533.

CALITE 87, the fifth annual conference on Computer-aided learning in Tertiary Education will be held at Sydney University from November 30 to December 2. Contact the Continuing Education Support Unit, University of NSW, PO Box 1, Kensington, NSW 2033. Tel (03) 697-3175.

The Eighth Australasian Conference on Coastal and Ocean Engineering is scheduled for November 30. It will be held at the AMC in Launceston and over 200 people are expect to attend. Delegates are expected to come from as far afield as Canada, England and Europe.

The Australian Society for Computers in Learning in Tertiary Education is holding its annual conference in Sydney on November 30-December 2. Contact (02) 697-3175.

DECEMBER

The Australian Urban and Regional Information Systems Association will hold its 15th annual conference, URIS 15, in Hobart from December 2-4. For full details contact the conference secretariat (002) 34-1424.

Intelligent Autonomous Systems Conference will be held over December 8-11 Amsterdam. Contact: Secretariat, Conference IAS c/o Congressbureau "Van Neutegen", PO Box 27783, 3003 MB Rotterdam, tel (010) 433-3179.

FEBRUARY, 1988

Space Commerce '88 is going to be held at Montreaux Switzerland over February 21-25. Those wishing to go should write or ring the Secretariat, Space Commerce '88, 2 Ave de la Gare, PO Box 122, Ch-1820, Montreux. Telex 453254.

MARCH

The World In Space is the name of the 1988 annual convention of the American Congress of Surveying and Mapping/American Society of Photogrammetry and Remote Sensing. Contact Jerome J. Lenczowski, 12775 Weber Hill Road, St Louis MO 63127.

MAY

An International Aerospace Exhibition is to be held at the Hanover Air Show from May 5-12. For more information contact Deutsche Messe-und Ausstellungs-AG, Abt 312 Messegelande, D 3000 Hannover 92. Telex: 9 22 728.

The Australian Bicentennial International Congress in Mechanical Engineering (Mech 88) will host a Conference on Space Engineering in Brisbane over May 8-13. To visit or participate contact the Institution of Engineers, Australia, Conference Manager, Mech 88 Conference, 11 National Circuit, Barton, ACT 2600. Telex: AA62758.

JULY

Australia's National and International Computer and Communications Exhibition and Conference will be held in the Darling Harbour area of Sydney from July 26-28. Potential visitors and exhibitors should ring (02) 959 5555.

Cannon Dot Signs

STC Cannon has won some large contracts with the Sydney and Adelaide public transport authorities for the production of destination displays for passenger busses. The same technology will also be used on the new Tingara rapid urban rail units in New South Wales.

The signs are composed of a matrix of hundred of small dots, each made up by toggling a small circular metal flap. Typically, one side of the flap is coloured white an green, the other side black. An electromagnet is then used to control the orientation of the flap. In this way, letters, numbers or graphic designs can be built up and displayed.

According to spokesmen at STC Cannon, such signs are ideal for large outdoor displays that must be clearly visible from a considerable distance. They beat either LEDs or LCDs in this regard. A side benefit is that they consume very little power. In fact, energy is only required to change the state of the flaps.

While such signs are not new, having being used overseas for many years,the software that drives them was developed in Australia by STC Cannon. They are designed so that they may be operated in a number of different modes. For instance, letters or digits can be entered individually from a keyboard. Alternatively, and of more interest to bus operators, a programme may be written that will allow a single keystroke to bring up a complete display. This can be extended so that a sequence of signs can be shown, with very simple inputs from the operator at the relevant times.

Services

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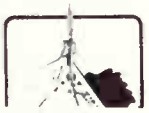

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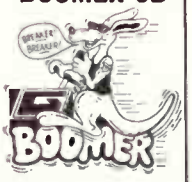

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CUT OUT AND KEEP

New transmissions from Europe, America, Oceania, compiled by Arthur Cushen.

Kilohertz Comment

NEW TRANSMITTERS

The long-awaited operation of the 500 kW transmitters by Radio Yugoslavia (with its subsequent increase in transmitting power) as well as two additional transmitters at KSDA and WHRI, have been noted recently on shortwave bands.

Radio Yugoslavia is using two 400 kW transmitters from its transmitting centre at Bijeljina and has been heard broadcasting several English programmes. Two frequencies are used, one at 2000UTC on 5980 and 6100 kHz for a 30 minute progamme and another at 2215UTC on 6100 and 7240 kHz . During the initial tests these broadcasts were heard one hour earlier as Yugoslavia was on summer time. Reception reports are requested to be sent to KSDA Radio Yugoslavia, PO Box 200, Belgrade, Yugoslavia.

The second transmitter at KSDA, Agat, Guam is now in operation and this 100 kW unit has enabled an expansion of KSDA programmes. In the initial period with only one transmitter, broadcasting was restricted and only on Saturday and Sunday was a full transmission of some 20 hours possible. The introduction of a second transmitter has enabled the programmes to be heard on a daily basis. Added to this there have been four times the number of English broadcasts heard since the introduction of the expanded programme. The schedule for English transmissions is 0000-0100 on 15125; 0200-0300 on 17865; 1600-1700 on 9830; 2100-2200 on 11965 kHz. The address for reception reports is KSDA, Adventist World Radio — Asia, PO Box 7500, Agat Guam, 96928.

The second 100 kw transmitter for World Harvest Radio International, South Bend, Indiana is now in service and this enables an expansion of the broadcasts, reports of the reception of the second transmitter are welcomed at the Le Sea Broadcasting Corporation, WHRI, PO Box 50250, Indianapolis, Indiana 46250, U.S.A.

WHRI reports that in its first few months of operation over 10,000 letters were received requesting verification and this encouraged the station to install its second 100 kw transmitter. Plans are also underway to install a transmitter in the Hawaiian Islands at a later date, which will be beamed to the far east. WHRI has two antennas, one for Europe and one for South America and is beaming programmes in two directions on the same frequency with its two transmitters. The new schedule or the second transmitter of WHRI is: 0000-0300 on 11705; 0300-0600 on 9850; 0600-0800 on 7400; 0800-1100 on 6095; 1100-1300 on 11790; 1300-1500 on 21700; 1500-1700 on 11790; 1700-1800 on 21700; 1800-2000 on 15120; 2000-2300 on 15400; 2300-0000 on 9770.

RADIO FRANCE EXPANSION

Radio France International had formerly planned a relay base in Sri Lanka but due to the unsettled political situation the station is looking for a new site for its South East Asia base. This could possibly be Thailand.

In a recent interview Jonathan Marks of Media Network, the head of the English section of RFI in Paris, indicated that a second relay base is under consideration. The second base will be on the Reunion Islands in the Indian Ocean. The plans cover a three year period and in the first stage two transmitters of 500 kw with three antennas are to built and they will cover the area from Madagascar up to the Persian Gulf. The second stage would include construction of a further transmitter which would beam programmes to Southern Africa.

Radio France International is now broadcasting 24 hours a day in French and has increased its output to 12 languages. There have been some changes to the English programming, and news is now being broadcast at 0200, 0330, 0415, 1110 and 1600UTC whilst a bi-lingual disc jockey type programme is broadcast from 0300-0500UTC for listeners in North America with announcement in both English and French.

The programme "Paris Calling Africa" 1600-1700UTC is to undergo change with the first half hour being news of an international nature, and news from France; and the second half is to be news about Africa and features. The programme at 1100UTC is now for world-wide reception, North and South America, Africa, Europe, Asia and the Pacific and is carried on 20 frequencies. There has been a dramatic response from English speaking listeners concerning the new programmes, but French speaking listeners are finding it necessary to re-tune when English is carried on RFI and look for the frequencies which are carrying only French transmissions.

SHORTWAVES

BRAZIL: Radio Brazil advises that Radio Nacional do Rio de Janeiro do not verify because of lack of time and personnel. The latest schedule of Radio Brazil, in English is 1800 to Europe on 15265; and at 0200 to North America on 11745 kHz.

CANADA: The Radio Canada International schedule from October 25 includes 2100-2129 Monday-Friday, 2100-2159 Saturday-Sunday on 5995, 7130 on 11945, 15325 kHz; 0200-0229 Monday-Friday, 0230-0259 Monday-Friday on 5960, 9755 kHz. The hour news programme of French and English is 0600-0700 with English 0615-0630 and 0645-0700, and French 0600-0615, 0630-0645 Monday-Friday is now on 6050, 7155, 9740, 9760, 11840, 15235 kHz. A further English transmission 0930-0940 Monday-Friday is carried on 5960, 9755 kHz.

IRELAND: Radio Dublin International is using the new frequency of 6930 kHz replacing 6910 kHz and has been heard around 0530 on Sundays with commercial programming.

MARSHALL ISLANDS: WSZO has extended its use of 6070 kHz to as late as 0800 when a frequency change is made for the balance of the transmission on 4940 kHz. This frequency is observed to closing at 1000UTC with announcements in English as well as local languages.

NEPAL: Kathmandu provides good reception on 3230 kHz with English news at 1415UTC. The other frequency 5005 kHz can also be heard but suffers from a new Indonesian station on that channel. Later reception of 5005 kHz is fair to closing at 1715UTC.

NICARAGUA: A new powerful transmitter and an extension of programmes has been observed with the Voice of Nicaragua operating on 6100 kHz with English 0600-0700UTC. This is a repeat of the earlier broadcast 0300-0400UTC which is carried on 6015 and 6100 kHz. The station is asking for reception reports to the Voice of Nicaragua, PO Box 248, Managua, Nicaragua, Central America.

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READER INFO No. 7

Paul Budde reviews the international position of videotex services

Videotex News

UK INSURANCE

The insurance arm of the British merchant bank Hill Samuel has a videotex service for the insurance industry. Intended for use by 30 branches, and 700 self-employed salesmen, the system has 100 users, and expects 500 more this year. First application is a client policy inquiry system updated daily giving agents access to information on the status of any policy. The system runs on an IBM 3083 using Langton Electronic Publishing Systems P111 software. This is connected via leased line to a Micro-Scope Videogate concentrator, to an IBM 3275 front-end processor running NPSI networking software, and then to the Prestel network.

VIDEOTAX APPLICATION

Motor cars, insurance, holidays, local information, retail stores are six apparently dissimilar elements of our life that represent the most successful applications of videotex technology to date.

However, the rapidly growing number of users include advertising agencies, credit houses, training department, hospitals and estate agents.

The key element is that computer experts and computer illiterates alike can master videotex systems. The technology is easy to operate; uses colour and graphics to good effect; is interative, allowing two-way communication and is economical to install and run.

BUREAU FACILITY

Sperry Corp — US is escalating its private videotex system sales effort through a service bureau facility operated by Commercial Data Processing. The service will be available at $US35,000 for three years' unlimited use and includes one year of unlimited computer processing, as well as training, consultation and limited work space at the CDP facility.

The centre is equipped with two Sperry 1100 mainframes, 64 asynchronous and 64 bisynchronous telephone lines, and Sperry's Mapper software system supporting ASCII, Pretel, CEPT and NAPLPS formats. Sperry's service bureau facility costs about half that for comparable service from other private system marketers.

PRIVATE VIDEOTEX

It has become clear that gradually CEPT will be accepted throughout Europe.

As Australia is closely related with the Prestel technology, it will be necessary to follow these trends more closely in Australia.

Recently the European CEPT commission issued the T/CD 06-01 document with hardware and software recommendations.

It is important to note in this document that there is now more freedom of choice between the different profiles described as follows:

Profile 1: Bildschirmtext
Profile 2: Teletel
Profile 3: Prestel
Profile 4: Prestel Plus

NUMEDIA

Numedia Corp is a worldwide brokerage and new media marketing partnership with US, European and Australian market leaders. Numedia now has local partners in Amsterdam, Bonn, London, New York, Sydney and Zurich. Charter clients include British Telecom, Computer Dynamics Products, International Datacasting Corp, and others.

Numedia was founded by Arthur Esch, also founder of the defunct Nabu Network cable project, and Thomas Wheeler past president of the National Cable TV Association. Paul Budde Communication is the Australian partner in Numedia and is currently developing a satellite-videotex network for Australia, based on Numedia technology.

KEEP IN TOUCH WITH THE DUTCH

Viatel has one full country presentation: the Dutch data base, launched by the Dutch Minister for Economic Affairs. The Netherlands Embassy, the Australian-Netherlands Chamber of Commerce, Netherlands' Board of Tourism, KLM Royal Dutch Airline, and Philips are some of the information providers.

Another Viatel "first" is the "News in Dutch" section in the Electronic Newspaper.

Dutch database 34530, News in Dutch 345673 on Viatel.

MARKETING ON-LINE TRANSACTIONS

Transaction processing (eg, teleshopping, and telebanking) services are the least-developed elements of consumer on-line services. They also happen to be the fastest growing. Furthermore, subscribers who come on-line to pay bills or buy records are the first for whom the application is more interesting than the medium — in other words, they are crossing over from the hobbyist stage and into an early adaptor market.

NEW GENERATION CEPT TERMINALS FOR SPAIN

One of Spain's leading banks, Banco de Santander, has bought 5000 Minitels for use with its home banking system, the first in Spain. Intelmatique is the bank's technical consultant in setting up the system. The Minitels were bought from La Radiotechnique through Philips of Spain.

Private companies in Belgium, Luxembourg, Netherlands and Switzerland have also placed significant orders for Minitels in recent months. Intelmatique has also introduced three new Inter-CEPT terminals capable of accessing all European videotex systems on Prestel, Antiope, or CEPT standard.

Transpres, a hardware system with two V24 interfaces, allows an Antiope terminal to emulate Prestel. Transister, a real-time converter, allows a Minitel to emulate CEPT. Jointel, a presentation level protocol converter, permits a videotex system using any of the three standards to be simultaneously accessed by terminals of all three protocols, doing all conversions in real-time. Prices for these black boxes range from $US600 to $US1150.

TELE GROCERIES

Telecard International's supershop in London is an on-line grocery ordering service on Prestel, the UK's national public videotex service. SuperShop offers 3500 grocery items to teleshoppers in upscale London areas. Products include food, household items, and wine. Product prices won't exceed those of the convenience food stores, which generally get an 8 per cent markup over regular supermarkets.

The customer must buy a minimum of £35 (about $US50) per order — which includes free delivery — and pay upon delivery by cash or check. The company projects 5000 users in the first year; 12,500 in the third. In the five boroughs of London where the service is being introduced, there are 8000 Prestel users out of a population of 360,000. Weekly grocery budgets in these areas average £46. To finance the proj-

ect, Telecard raised £600,000 in a recent public offering, and the British Telecom unit running Prestel has taken an option to acquire 10 per cent of the venture. British Telecom has also agreed not to back any similar competing teleshopping ventures in London for at least two years.

BUSINESS VIDEOTEX IN THE US

Business videotex in the US will grow to a $US1.49 billion industry by 1990, up from $US29.7 million in 1985, according to Frost and Sullivan (F&S). The F&S study cites the "closer user group executive information systems" as videotex's most dynamic market segment, growing from $US1.8 million in 1985 to $US609.5 million by 1990, due to the proliferation of office personal computers.

Competition will spur "automated order entry' to take 26 per cent of the wholesale/retail market by 1990, and will post $US100 million in sales by 1988 and $US400 million by 1990. "General purpose systems" will rise from $US13 million in 1988 to $US263 million in 1990. "Real Estate Systems", currently the largest market segment, will rise from $US19.9 million in sales to $US226.2 million in 1990.

TEX TERMINAL IN MEDICAL APPLICATION

New Dimensions Ltd a new company, has acquired the patents and licensing rights from Arthur D. Little Co to Tex, the Prestel-format videotex decoding terminal previously manufactured and marketed by Telelogic. New Dimensions is to use a Tex terminal for a medical information network it will test in New Jersey connecting hospitals computers to over 1000 doctor's offices and clinics. The company expects Telelogic to manufactue units on subcontract basis.

(In 1984, Telelogic presented a demonstration Prestel terminal for $US100 — ed.)

KODAK DEC INFORMATION CENTRE

Eastman Kodak is using a DEC VAX VTX private videotex system for handling phone inquiries to its consumer assistance Information Centre. The newly established unit cost Kodak about $US600,000 to set up; the purpose is to handle customer calls about photo equipment, film, and processing. The Kodak Information Centre handles 700 calls in 14 hours per day by 30 representatives. Information can be retrieved a tree menu or keyword search; Kodak estimates a 30 per cent gain in productivity by accessing information via videotex instead of through print manuals. The DEC VAX VTX system is front-ended onto existing IBM mainframes; some problems encountered passing through information from word processing facilities to videotex systems because of formatting and moving commands.

THAI VIDEOTEX

A Thai university is using a videotex system from Tayson Information Technology of Canada for its distributed educational service. The 60,000 student university installed Tayson's Viatel instructional program to service students unwilling to relocate from throughout the country to a central campus. Instead, users go to a local centre where they can access Viatel program modules through a dial-up service. Students identify themselves with a personal password; the system allows them access only to the modules for courses they take.

The system provides instructional modules to supplement classroom and textbook sessions, multiple choice tests, and instant scoring tests to both students and professors.

LIMICON REDESIGNS NAPLPS

Limicon (Canda) has redesigned the videotex NAPLPS standard for use in animations, process control, and robotics applications. Limicon has developed e-naps (extended NAPLPS), which subsumes the SRM to create a highly compressed programming and transmission language. The process is designed for control of multiple robotic devices and real-time graphic reporting of the status of industrial processes, as well as for an animation tool set.

E-naps operates with Softbus, running under MS/DOS 2.0+, which allows multiple programs to share and access the same data simultaneously. E-naps graphic creation is accomplished with ProDraw. E-naps products include Animate animation software for $US1000 and Chartright charting software for $US100. Softbus and ProDraw cost about $US100 each.

HONEYWELL'S INFONOW

The New Hampshire Department of Human Services is a beta test site for Honeywell's Infonow private videotex system. The videotex system is being used to deliver electronic editions of nine bulky policy manuals statewide to 450 field workers. A private videotex system was chosen over a word processing system due to the expense of dedicated word processors.

10 BILLION TRANSACTIONS

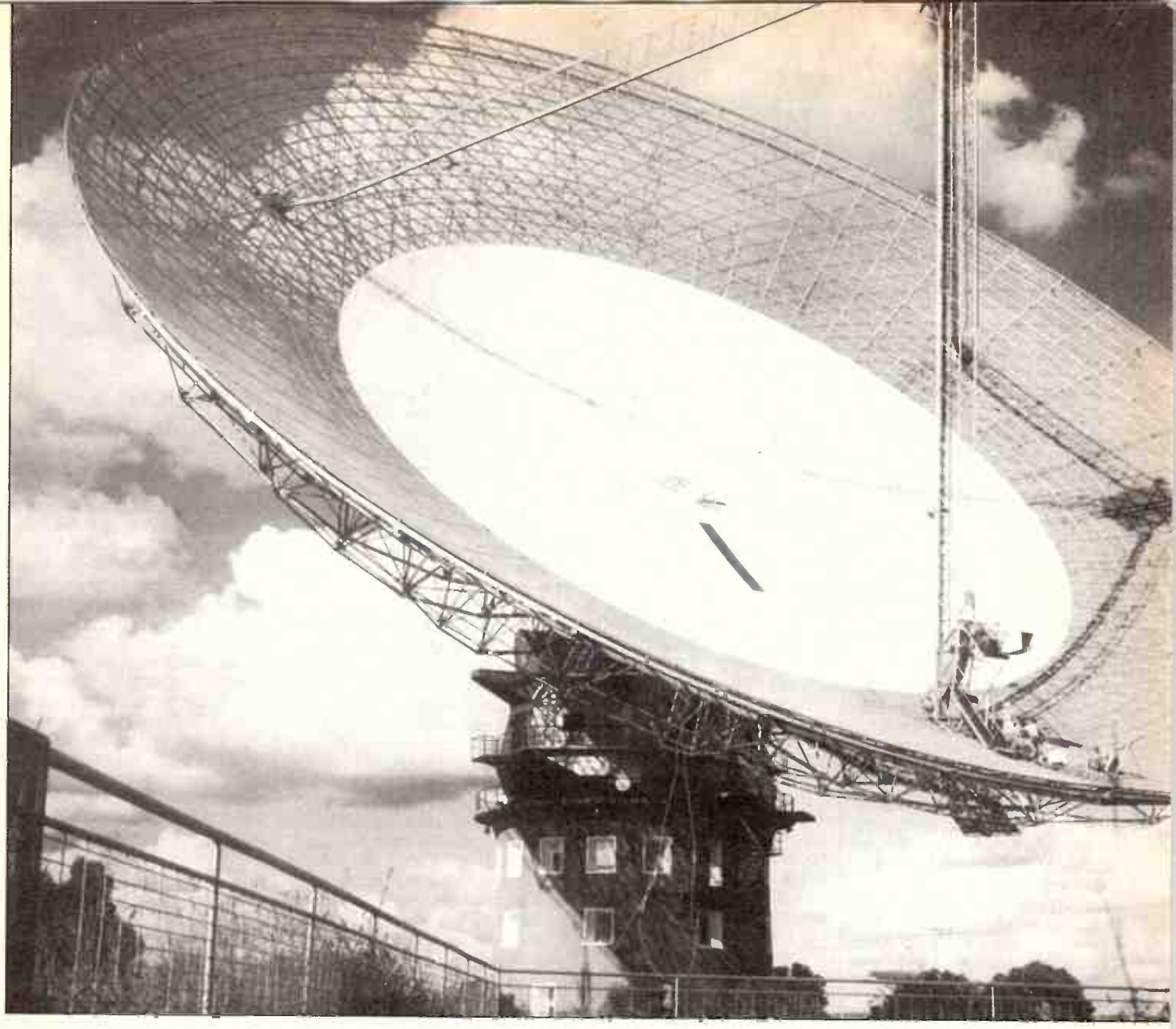
A Bank of America Corporation senior executive says 10 billion transactions per year are potentially transferable to telebanking systems. The figure is based on the bank's assumption that up to eight check payments per month could be switched to telebanking. Another 20 per cent of the personal checks per month may migrate on point-of-sale debit payments. Home banking technology is characterised as a multimillion dollar capital investment with long payback times; the executive admits the cost to support BoA's Home Banking service is more than the revenues generated by it.

METROTELLER HOME BANKING

Metroteller Systems, an Empire of America Bank subsidiary (EoA), is marketing its telebanking service to its 70 ATM Network member financial institutions. The telebanking software was licensed by Metroteller from another EoA subsidiary — Macrotel — which provides frame creation and system management.

Macrotel licensed the software from Genesys, a Canadian software house. The videotex service provides funds transfer, bill payment, and account inquiries for Apple, Commodore, and IBM PC's.

EoA currently has about 100 subscriptions on its flagship service. It says a credit union and another financial institution will use the software for customised branch information, and then expand into home banking, though no timetables were mentioned.



TELESCOPE EARTH

Brian Dance gives a survey of the latest in telescope technology.

IN the quest for the ever greater resolution of astronomical objects, larger and larger arrays of radio telescopes are required to provide extremely large bass lines. The largest system currently in regular operation is at the National Radio Astronomy Observatory (NRAO), USA. This enormous Very Large Array (VLA) at NRAO is operated by Associated Universities Inc and is located in the plains of San Augustin near Socorro, New Mexico. It consists of 27 huge mobile dish aerials each 25 m in diameter and weighing over 200 tons.

A new Very Long Base Line Array (VLBA) currently under construction in the USA will provide a far larger base line than the VLA. The installation of the first of ten identical 25 m antennas for the VLBA was completed early in 1987 at Pie Town, New Mexico, while a second antenna is being constructed at Kitt Peak, Arizona. Antennas will also be built at Hawaii and in the US Virgin Islands to provide a base line of maximum length about 8000 km. The VLBA will be completed with further antennas at six other sites spread across the USA.

Although the VLBA will be by far the largest array, high resolution radio astronomy is a growing international science. There is already an expanding network in Europe and a network under construction in Australia.

Five of the VLBA antennas will be placed in the southwestern USA where the predominantly clear, dry weather conditions are expected to minimise phase fluctuations due to water vapour in the atmosphere. These five fairly closely spaced sites will be used for shorter base line, lower resolution work. They are also near to the VLA in Socorro where the VLBA control centre will be located to facilitate interchanges of VLA and VLBA person-

nel. The VLBA will cover the whole of the northern hemisphere and part of the southern region, providing far better images of most of the radio sky than are currently available.

Although other widely spaced radio telescopes in Australia, Europe, the USA and Russia have occasionally been linked for shorter periods, the VLBA will be the first dedicated radio astronomical array of fully continental magnitude. The problems arising from the use of temporary links not designed for interferometric work will be eliminated. These problems include the very limited periods of availability of antennas provided for other purposes and the shipping of specialised interferometric equipment to the sites concerned for limited periods of use.

There has been considerable international collaboration in Europe where radio telescopes built mainly for other purposes has been linked to form arrays with base lines up to 2500 km. The European Very long base line Network (EVN) incorporates antennas in England, West Germany, The Netherlands, Italy, Sweden and Finland. Further antennas will be added to the network, including those under construction in Poland and in Sicily, but the maximum EVN base line has been obtained with the collaboration of a Russian station in the Crimea.

Resolution

In order to appreciate the need for a base line of inter-continentxal magnitude to achieve the best resolution, one must consider the wavelengths to be received. Optical telescopes with mirrors more than 5 m in diameter have been built, but they operate at visible wavelengths (about 360-780 mm). Radio astronomical telescopes operate at wavelengths about 200,000 times greater than this (typically in the 10 cm region). For the same resolution as a 5 m diameter optical telescope, the diameter of a radio telescope would therefore have to be some 200,000 times greater than 5 m, namely about 1000 km. A single dish of such a size is quite out of the question, but a number of separate dish aerials can be located at widely separated locations and linked together.

The 8000 km base line of the VLBA will provide an angular reolution of about 0.2 milliarc-seconds. This is about 100 times bigger than that provided by the best optical telescopes and 100,000 better than that from the largest single radio astonomy antenna. This resolution is comparable to that needed to read a newspaper at a distance of about 4000 km.

This amazing resolution is obtained by using two or more radio antennas as an intefermoeter, the signals from them being combined in a computer. Difference in the path lengths of the waves reaching the telescopes lead to complex interference patterns; these can be analysed by computer to find the position of each radio source very accurately. In general the resolution provided by an array of radio telescopes is comparable with that which would be obtainable from a single antenna of a diameter equal to the distance across the array.

Although this interferometric technique has been used for radio astronomy for about thirty years, adequate computing power to store and analyse the enormous amounts of data thus generated has been available only for about the past fifteen years.

The VLA

The VLA comprises an array of large antennas mounted on rails and is in the shape of a letter Y. One arm of the Y extends 19 km to the north and the two other arms 21 km each to the southwest and to the southeast respectively. These antennas can be moved to provide arrays with baselines ranging from 1 to 35 km. Construction of the VLA commenced in 1974 after a proposal in 1967. Six of the antennas came into operation by 1977 and the array of 27 antennas was completed early in 1981 at a cost of just under US$80 million. The array is operated continuously for studying the solar system and objects in both our galaxy and in other galaxies.

The VLA provides an optimum resolution of 0.13 arc-seconds when the antennas are fully spread out; this is comparable with that of some of the best optical telescopes. Signals are received over five bands from 330 MHz (91 cm) to 23 GHz (1.3 cm).

The VLBA

In 1982 the NRAO proposed that the much larger VLBA be built to enable fine detail in the structure of distant quasars and galaxies to be seen which could not be resolved by the VLA. Work started on the US$75 million project in late 1985.

Frequency	Wavelength
330 MHz	91 cm
610 MHz	49 cm
1.5 Ghz	20 cm
2.3 GHz	13 cm
5.0 Ghz	6 cm
8.6 GHz	3.5 cm
15 GHz	2 cm
23 GHz	1.3 cm
43 Ghz	7 mm
86 Ghz(?)	3.5 mm(?)

Table 1. VLBA antenna design operating frequencies and wavebands.

The VLBA antennas have been designed to operate in the first nine bands of Table 1; they include all of the VLA operating bands so that the two arrays can be combined when this is desirable. A tenth band at 86 GHz may be added to the VLBA system later, partly because the shorter wavelength would raise the resolution to 0.1 milliarc-second.

Low noise GaAs FET devices will be used in the VLBA system to amplify incoming signals in the bands from 330 MHz to 15 GHz. High Electron Mobility Transistors (HEMTs) will be employed for amplification in the 23 GHz band. For opera-

tion at frequencies from 1.5 Ghz upwards, the GaAs FET and HEMT devices will be cooled to 15 k (−258°C).

Instrumentation

Each station will have two high speed tape recorders capable of storing 128 Mb of data per second continuously, and even higher data rates for limited times. The 11 km of tape thus produced each day from each of the ten stations will be sent to the VLBA data processing centre. At this centre computers able to perform 10^{12} operations per second will transform the data into very detailed images of the radio sky.

The data processing centre will be able to use information from up to 20 tape replay systems. It will therefore be easy to increase the sensitivity and/or the resolution of the VLBA by including information from antennas other than those in the main array.

Applications

The VLBA will be employed to study the evolution of stars and other relatively compact objects within our own galaxy. For this application it will offer the great advantage that radio waves can travel through the relatively thick clouds of dust and gas which absorb the visible wavelengths detected by optical telescopes. The VLBA will be able to detect the radio signals emitted by molecules within our dust clouds from which new stars are being formed. Similarly it will detect the radio emissions from molecules in the atmospheres of dying stars.

Astonomers will be able to use the high resolution provided by the VLBA to directly measure distances of objects throughout our galaxy and in some neighbouring galaxies. This could assist our understanding of the evolution and ultimate fate of the universe. It may also help to determine how rapidly it is expanding, etc.

An important application of the VLBA at greater distances is in the study of the energy sources of distant radio galaxies and of quasars (quasi-stellar objects). Much data on quasars has already been obtained by the use of the VLA and other radio telescopes, but the much higher resolution which will be offered by the VLBA is required to study the energetic cores of quasars in detail where violent explosions are taking place. Here again the ability of the VLBA to see through dust clouds will be invaluable.

It is not surprising that the applications of the VLBA are not confined to astronomy. The measurement of the precise astronomical positions of very distant galaxies and quasars will enable them to be used as fixed reference points so that the relative positions of each of the measuring antennas in the array can be calculated to an accuracy of a few mm. Long term changes in the relative positions of the antennas will provide information on continental drift and on the deformation of the earth's crust. The accurate data on the antenna positions will also enable small changes in the rate of rotation of the earth to be observed and information will be obtained on the wobbling of the earth on its axis.

Australian Telescope

The Australia radio telescope array will offer a unique observational facility for the southern hemisphere when it is completed in 1988, since it will be able to receive signals from objects which, owing to their location, cannot be studied by the VLBA or by the EVN.

The Australia telescope will include an array of six telescopes, each 22 m in diameter, which will be positioned along a 6 km line at Culgoora (near Narrabri), NSW. As in the case of the VLA, these antennas are being built on rail tracks to enable them to be moved into various positions to produce different base lines.

> ***"This resolution is comparable to that needed to read a newspaper at a distance of about 4000 km."***

A similar 22 m diameter seventh telescope is under construction 115 km to the south at the Siding Spring Observatory near Coonabarabran. The much larger existing 64 m diameter telescope at Parkes is to be included in the array so as to increase the base line to 320 km. The total cost has been estimated at nearly US$30 million.

Frequency	Wavelength
1.5 GHz	20 cm
2.3 GHz	13 cm
5.0 GHz	6 cm
8.5 GHz	3.5 cm

Table 2. Initial operating frequency and wavelengths of the Australia telescope.

The Australia telescope will initially be operated in only the four bands shown in Table 2. However, it is intended to add another seven operating bands later ranging from 330 MHz (91 cm) to 116 GHz (2.67 mm).

The size of the Australia telescope will be increased when necessary by collaboration with other stations. The large 60 m diameter antenna at Tidbinbilla will sometimes be used; it forms part of NASA's deep space network for communicating with inter-planetary spacecraft and will therefore be available for interferometry only for limited periods. Similarly, the University of Tasmania's 26 m diameter dish located in the Hobart area could be included in the Australian telescope when a longer base line of some 1400 km is required. The use of this telescope should improve the resolution to about 4 milliarcseconds.

International Collaboration

As is the case with all extremely high cost scientific projects, the future for extremely high resolution radio astronomy lies in an international collaboration. As the Australia telescope, the EVN and the VLBA will operate at many similar wavelengths, there is the opportunity to combine these networks not only to achieve base lines about equal to the diameter of the earth, also to provide wide directional coverage.

Some inter-continental collaboration has already taken place. Perhaps the most notable yet was in 1986 when the Australian Tidbinbilla antenna (64 m) was linked with the Japanese Usuda antenna (64 m) and two 4.9 m antennas on one of NASA's Tracking and Data Relay Satellites (TDRS) in orbit around the earth. Base lines of nearly 17,800 km (about 1.4 times the diameter of the earth) were reached in 2.3 GHz studies of the radio emissions from three quasars.

Space arrays

The ultimate objective for ultra-long base line radio interferometry is the use of widely spaced antennas in space. These antennas should not only be widely separated for optimum resolution, but for many applications must be large in order to obtain maximum sensitivity for good signal to noise ratios from extremely weak radio signals. It seems probable that such antennas in space would be on earth orbiting vehicles whose position can be accurately determined.

NASA and the European Space Agency are currently considering proposals for orbiting antennas which would provide resolutions of 75 microarc-seconds or better. Frequencies of up to 23 GHz could be employed, but at least five years would almost certainly pass after the approval of such a system before it could come into operation. Base lines up to about twice the diameter of the earth should be achieved. ●

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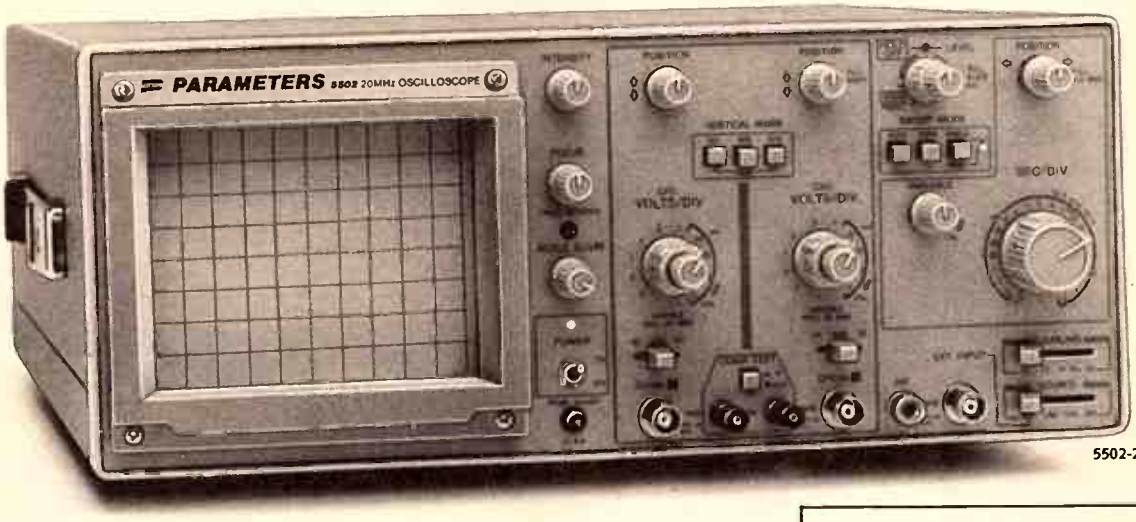

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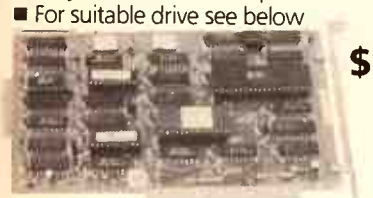

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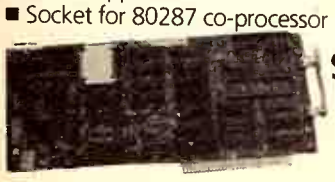

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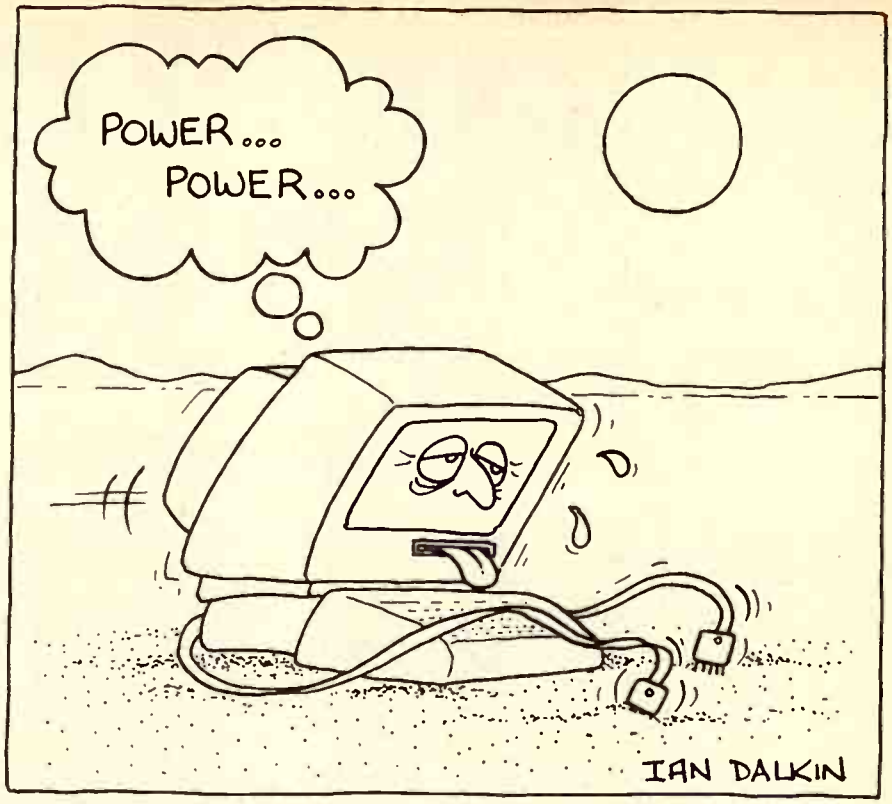

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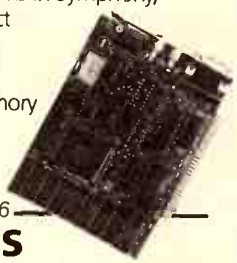

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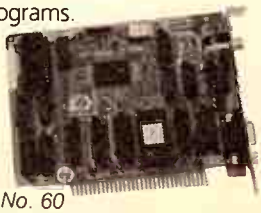

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READER INFO No. 60

Colour Graphics Video Card

- Suits RGB and composite colour monitors
- Light pen interface
- Fully CGA compatible
- 40 x 25 & 80 x 25 (text), 640 x 200 (mono) and 320 x 200 (colour)

$115

READER INFO No. 61

Colour Graphics/ Printer Adaptor

Attaches to IBM-compatible RGB monitor; provides complete compatibility with IBM Colour Graphics Adaptor. Equivalent to the IBM colour/graphics adaptor with additional printer port to replace the video port originally supplied by IBM.

$145 *READER INFO No. 62*

Parallel Printer Card

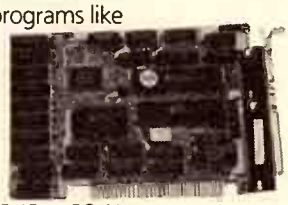
- Standard TTL level
- Centronics printer port, full IBM, EPSON compatible

$44

READER INFO No. 66

Turbo Mono Graphics/ Printer – Short Slot

If you want fast, flicker free scrolling and full Hercules compatability, this is it! Perfect enhancement for slow scrolling programs like Microsoft Word etc. The ultimate monochrome graphics card.



$175

READER INFO No. 74

Serial RS-232 Card

- Independent receive clock input
- 2nd serial port option
- Full buffering eliminates need for precise synchronisation

$55

2MB EMS Memory Card for PC/XT or AT

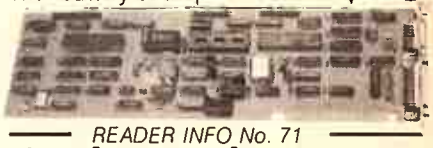
An affordable "Above Board" memory card. Fit up to 2MB of high speed RAM (0K fitted). At a low introductory price: **$495**

READER INFO No. 70

Multi I/O Card

- Floppy disk adaptor, 2 drives DS/DD
- 1 serial port, 1 parallel port, 1 joystick port
- Clock/calendar with battery backup

$175

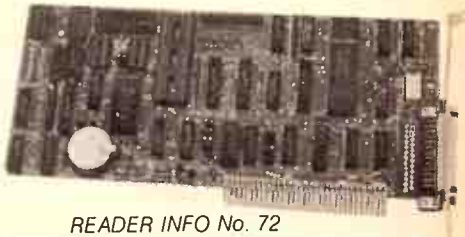


READER INFO No. 71

I/O Plus Card

- Clock calendar with battery backup
- 1 serial port, 1 parallel port, 1 joystick port

$136



READER INFO No. 72

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2.5MB Multifunction card for PC/AT

READER INFO No. 63

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- One parallel printer port
- Memory expansion to 2.5MB (0K fitted)
- Fully PC/AT compatible

$495.00 *READER INFO No. 67*

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READER INFO No. 64

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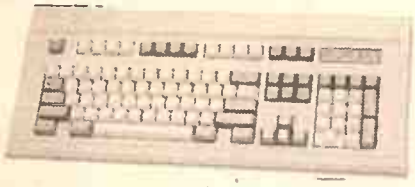
- On-board battery backup, real time clock
- Phoenix ROM BIOS

$995 *READER INFO No. 68*

Enhanced Keyboard suit both PC/AT and XT



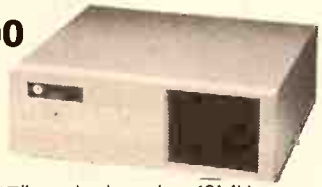
The finest keyboard on the market.

- Suits both IBM PC/XT and AT (switchable)
- Full 101 keys with separate cursor and numeric pad
- Superb key action
- Lights for caps, num and scroll lock

$195.00 *READER INFO No. 65*

Baby AT Case

$135.00



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- Keyswitch, reset/turbo buttons, indicators

READER INFO No. 69

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TULDIN

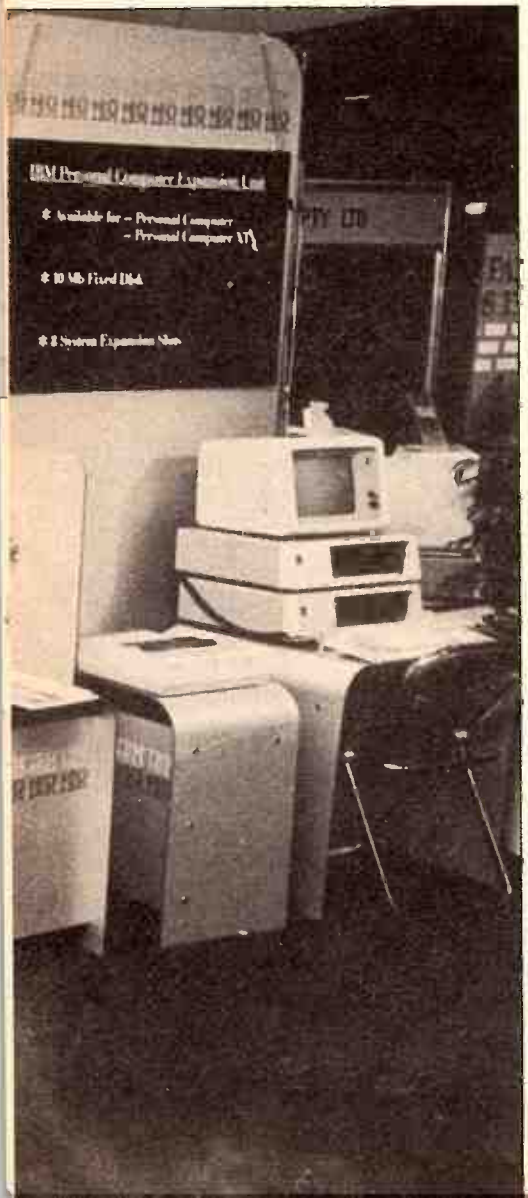
THE IBM ENVIRONMENT

A special feature on the effect of IBM on the small computer market. Is it a monopoly or an environment? How do you get the best out of it?

Jon Fairall

The personal computer can easily be seen as the living embodiment of both the acceptable and the unacceptable face of capitalism. It was created by two young men working late at night in Aunty's garage. By dint of nothing except faith in themselves and tremendous energy they created an entire industry and changed the way business was done, children were educated and (even) magazines published.

In the nature of the case, the founders of the Apple soon had imitators, imitators by the bucket load. Everyone made money. But just as with any good marxist dialectic, the success of those early computer pioneers also contained the seeds of their downfall. As the punters flocked to the stores to buy pcs, it was inevitable that sooner or later, someone would demand to know what it was all for. And because the entire industry was being managed and run by technobrats, its not surprising there were no answers.



There were two incompatible trends at work. On the one hand, the computer makers were holding up visions of the future splendid: the paperless office and automated home, text and data transfer on an unimaginable scale, increases in efficiency, and profits galore. The trouble with this vision was that it depended on every machine being able to talk to every other machine. It depended on every machine being able to run the same software, do the same job. Most of all, it depended on the users of different types of computer being able to talk to one another.

Communication Anarchists

Anarchists are not good at communications, and the early pc makers were nothing if not anarchistic. Why talk when you can throw a bomb? And throw bombs at one another they certainly did. Apple bought out the Apple II. Atari launched something with more speed and better graphics. Commodore beat them both with an unbelievably low price. Then some total nonentity launched another product with twice the memory and half the price. Meanwhile, Apple was back at the drawing board trying to obsolete the rest of the industry. So it went round, in a breathtaking spiral of increasing performance and decreasing cost.

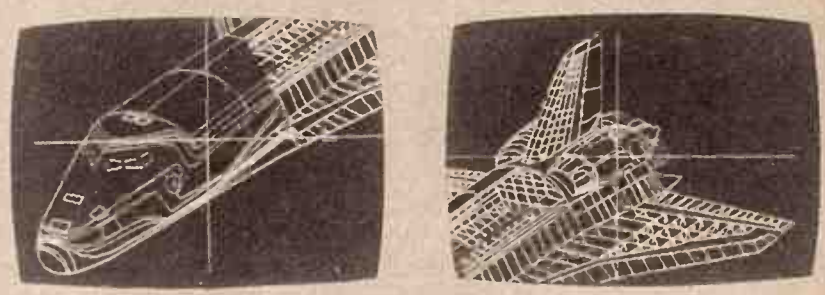
The bubble had to burst. And it did, when the consumers began to adopt the only credible posture in the face of these inflationary specifications: they waited for next week, secure in the knowledge that prices would have dropped and performance increased.

The makers held dulsatory conferences, and discussed standards and motherhood, but nothing ever came of it. And one day they woke up to find Big Blue, the lumbering giant of the US electronics industry, sitting right in their back yard. Their pc was a ridiculous device, utterly contemptible in terms of price, performance and every thing else. But it had one thing the others did not: three letters on the front of the box.

IBM

When IBM moved in on the market, virtually every other machine became obsolete overnight. Despondent manufacturers moved out of the market decrying the stultyfying effect of the giant corporation. Worried letters appeared in the press about end of the world as we know it. Would IBM soon own everything?

That may well have been IBMs game plan,



Panning and zooming in 0.1 of a second

DESIGNING THE SOFTWARE

Because the pc has become so standardised it has attracted a wealth of software. Generally, designers have gone to a lot of trouble and expense to get around the basic problems of the PC's architecture. However, the more successful programmes, AutoCAD would be a case in point, have succeeded to such an extent that they themselves have become accepted as industry standards. Now hardware makers are making boards specifically tailored to the demands of the software.

This combination has made for some quite spectacular advances in performance that have nothing at all to do with the speed or any other specification of the pc, but everything to do with an integrated hardware, software approach to solving problems.

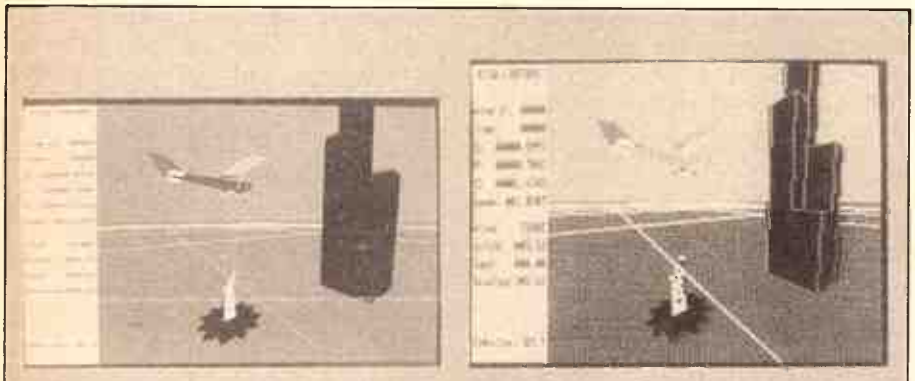
For instance, as all users of CAD systems will know, the biggest problem with actually using a programme is the screen regeneration time. It takes ages to recalculate and redisplay all the information on the screen. This is acceptable if you have to do it once at the beginning of a session. Its painful if you have to do it every ten minutes.

Typically, with a reasonably complex drawing on the screen, thirty seconds is a typical regeneration time. But there are cards on the market now that will allow you to pan or zoom on a drawing essentially in real time. Cards like this also employ special circuitry to assist with common computational problems.

but in the end, they did not anticipate one interesting development. Those same hackers who had once so enthusiastically built their own machines started pulling the IBM apart.

Between their giggles of contempt, it dawned on the hackers that while the game had changed, the rules were still the same. The name of the game: Cloning; the new rule: exploring the boundaries of the feasible.

Within months of the release of IBMs personal computer, the first compatible computers began to appear on the marketplace. In the beginning there was some argument about exactly how compatible, compatible meant, and court battles galore as everyone sorted out the difference between infringing an IBM copyright, and legitimate design. Today, however, IBM in the pc world is not so much a company as an environment.



A comparison of two frames, one using a conventional CGA and the other an X1 Graphic Board.

3D Graphics

Sublogic, the company that first developed the famous flight simulator programme, sell a 3D graphics package called the 1B-3D1 which contains a real time animation language, a 3D graphics editor, a viewer, and a digitizer. It requires their X1 board set for best results, plus 256k of RAM on the motherboard.

The animation language was originally created for company only use during the generation of the flight simulator programmes. It includes commands to draw lines, points, and polygons in both two and three dimensions. There is also a routine for hidden line removal and object sorting.

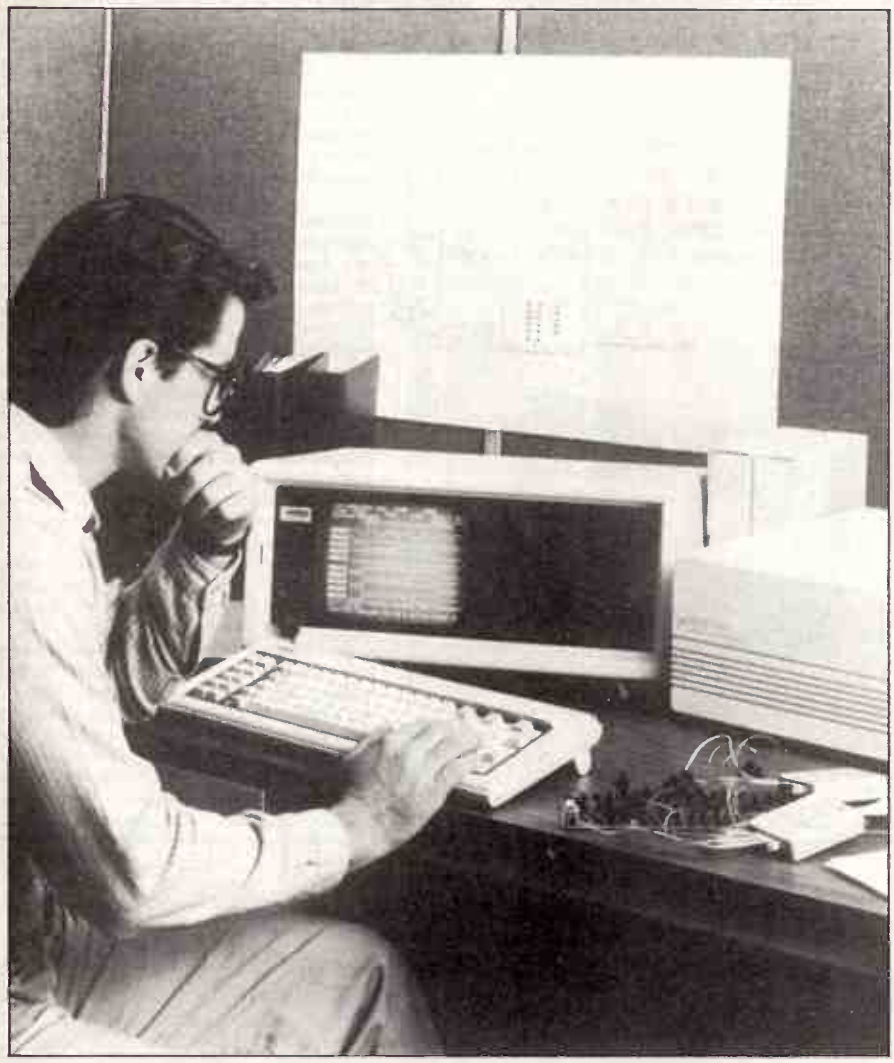
To do this sort of thing on a pc, some clever hardware manipulation is required. The X1 comes as a two board set, and performs all 2D to screen coordinate transforms on one of the boards, independent of the rest of the system. This is actually done in an Application Specific IC, called the graphics microprocessor, specially designed to convert line vectors to screen coordinates. Since this transform is done in hardware, the X1 is capable of much faster drawing speeds than boards that require software to perform the same function. There are also eight video shift registers to assist in transfering the information to the screen RAM.

De facto Standard

It's the de facto standard, and it has been responsible for a number of interesting developments. Firstly: No matter what your brand of computer, it will operate much the same as everyone elses, provided only that they are IBM compatible. Naturally there are huge variations in price and performance, but transferring skills from one to the other is relatively simple. Second: The existance of a hardware standard means that software can be designed to the standard. This in turn means that any bit of software will run on any computer. In the business world, this means that people can be trained to operate software rather than computers. A secretary can learn Wordstar for instance, and make her skills transportable from job to job.

Thirdly, the existance of a standard means that designers can design peripherals in the knowledge that they are designing into a huge market. This has changed this section of the market beyond description. In many respects it is now the most interesting part of the industry. Vendors are in the wonderful but paradoxical position where they not only have a standard to work to, with all the advantages that that brings, but also the flexibility to tailor computers to specific applications. It's called having your cake and eating it.

It works because IBM, in the original design of the PC, split the circuit in two. At the bottom was a motherboard with the core



TEST GEAR

Almost every type of test instrument has by now been implemented on a pc board. Although rarely having the performance of dedicated stand alone instruments, they offer a price for performance mix that can be very attractive, as well as offering all sorts of facilities for manipulating information.

One of the earliest and still the most classic use has been the implementation of oscilloscopes on a pc. The card usually consists of a high quality Analogue to Digital Converter. The information is passed onto the pc where it can be displayed as a waveform, or perhaps some other type of signal massaging can take place — a fast fourier transform for instance. The software for this is loaded into the system via the normal floppy disc input. In much the same way, spectrum analysers, frequency and voltage meters and many other types of test gear can be realized.

Another type of application with this sort of architecture is the development system. These vary from EPROM emulators, or processor emulators, right up to full blown in-circuit emulators that will take over and run a target system under the control of the PC. This can be an extremely cost effective way of building a development system.

Using all the processing speed and high definition graphics of a fully optioned IBM compatible, it's possible to do complex simulations of circuits using rigs like this. While it's still not possible to do the type of circuit simulation one can achieve on a mainframe, still, an engineer can have access to an enormous amount of computing power on his desk. Courtesy Scientific Devices (03) 579 3622.

of the machine on board. There were also a couple of expansion slots to take circuit boards. The idea was that the rest of the circuitry could be built on them.

It didn't take long for other electronics companies to realise that these slots could be used to re-configure the basic pc in almost any way required. If the inbuilt graphics are not up to scratch, rebuild the graphics circuitry. Don't like the I/O facilities? Rebuild them. And so it goes.

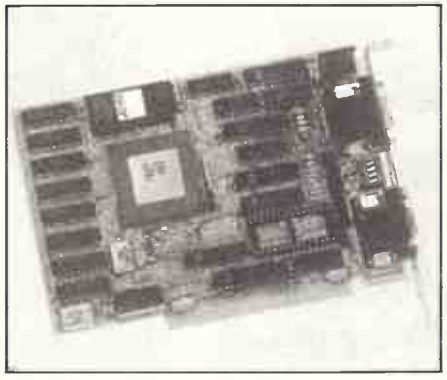
Categories

Today there is a huge range of add on cards that can be used to reconfigure the basic pc to optimize it for almost any requirement. There are boards designed to enhance the functioning of the pc itself, help it communicate and change its basic purpose.

In the first category are included memory and speed up boards, graphics and disc controllers. In the communications category a whole arsenal has been developed that allows the pc to be configured to almost any communications strategy one might care to adopt.

All these applications make the pc more attractive for a particular job. In the extreme the pc is used merely as a host for display, and most of the work is actually done on the board itself. In this category fall all those highly specialised applications boards, for instance, those that turn the pc into a test instrument of some kind: an oscilloscope or development system for instance.

A final trend worth noting stems from the observation that with a standard set in concrete, software designers have been able to design software that will run on a multitude of different computers, thereby setting industry standards in their own right. Now vendors are starting to design boards specifically tailored to the needs of particular software packages.



The picture shows a highly integrated multifunction card from NEC. It has three video modes, extra memory and a printer port.

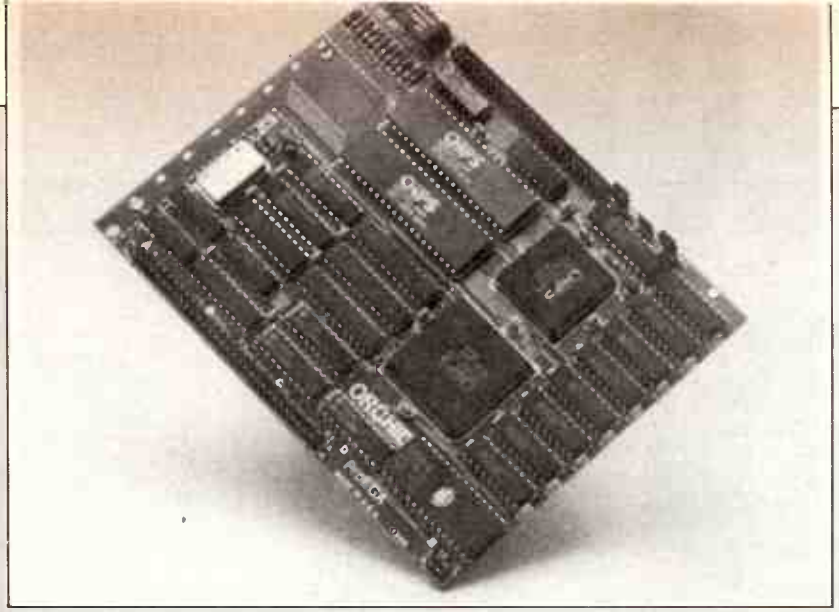
ENHANCING THE PC

The standard pc had rather poor graphics management systems on board, so a whole swag of cards have entered the market aimed at improving the graphics handling ability of the pc for applications where improved graphics is important.

At various times there have been a number of different standards on the market; but now the industry seems to have standardised on a very few. The most popular is the EGA (Enhanced Graphics Standard), which has 640 x 350 pixel resolution and colour. These are available from virtually every dealer, mostly sourced cheaply in SE Asia. Others include Hercules, and PGA (Professional Graphics Adaptor) which both have 720 x 348 resolution in monochrome. Some manufacturers, like Tseng International, have devised cards that allow the user to select between these various standards as appropriate. The Tseng card will switch between all these standards on the basis of hardware switches as under software control. It's available from NEC (02-868-1811).

However, this is an expensive option if you don't need the flexibility. Earth Computers (03-439-4900) sell Hercules cards from $425 for instance.

Of course graphics enhancements are of little use without speed to back them up. The pc itself runs at 4.77 MHz. Cards are now available that will yield 8, 10 or even 16 MHz. They usually depend on replacing the processor on the motherboard with a new



A recent development in increasing the flexibility of pcs has been the advent of multifunction cards. Often using the latest in surface mounting and large scale integration they allow a number of different and unrelated functions to take place on one card. The consequence of this is that the slots on the pc motherboard don't fill up quite as fast as they would otherwise.

advanced processor like the 80286 or 386 running at high speed. A typical example is Orchid's Jet386 card which gives a claimed speed three times that of a standard AT.

In some cases, replacing the processor may also involve replacing the software. NSD (03-890-0970) sell a 32 bit high speed card that uses Unix. In fact, the NSD card, as well as 10 MHz no wait state performance, also offers 4 M of memory on the board, all for $6000. Largely, this is way out of the amateur class.

These speed up cards must compete head on with another strategy for improving the computer, namely replacement mother boards. Some manufacturers offer this as a viable way of improving the performance of (say) a PC up to XT capability. For instance, Pulsar sell an AT motherboard that is designed to drop into the existing pc case. It runs a 10 MHz 80286, has 1 M of RAM, all the video standards, real time clock and five 1/0 ports on board.

Another, extremely popular type of card is the enhanced memory card. The earliest pcs were sold with only 64 k on board. Today this is typically 512 k, a function both of the way in which memory has come down in price and the way in which software has increased its demands on memory. Many of the latest user friendly programmes demand 640 k.

640 k represents the maximum amount of memory that MS DOS will address. Card vendors have used some clever tricks to allow the host pc to use more. For instance, one can organise several megs of memory in banks of 640 k, with the appropriate software on board to manage the switching as Orchid have done with their ECCELL cards. They will support up to 12 Mbytes on one card. It's available from Porchester. A new solution in which the card comes with several meg, plus a low profile hard disc actually integrated into the card is offered by the Plus 4 hardcard, distributed by Tech Pacific (03-690-9055). Using clever management, it is possible to swop banks of memory between the silicon and the disc. Provided the programme doesn't make too many demands on different areas of memory, this is a quite practical way of extending memory into the gigabyte range without the expense of an endless array of chips.

Computer Networks distribute cards that allow up to 50 users to join together in a local area network.

COMMUNICATIONS

A second area where add-on boards have proliferated is in the communications area. As the use of pcs has expanded, the desire to communicate has expanded with them. There are a number of different ways in which this is happening. At the very simplest level are the various I/O boards. These typically have several centronics and RS 232 parts available, perhaps a games port or two for a mouse or joystick. A sophistication of this idea will allow simple file exchange between computers with a modem. In this application, the pc still functions alone, but has the ability to access the phone lines when required.

An enhanced version of this idea is the Local Area Networks (LAN), where the computing power of an organisation is distributed through a number of pcs, but all can share common access to peripherals like disc drives and printers, and all access common files. Typically, cards for this application make the communications happen in the background, so that the user remains unaware of the data flow into and out of the machine. This means that the normal functioning of the computer can proceed when data transfer is taking place. JIT (03-720-1333) are distributing the Starlan range from Western Digital which does just this.

A third general type of architecture is one where the pc is made to look like a terminal hanging off a mainframe computer. Most large computer vendors now stock cards that will allow a pc to integrate into their networks using one of these. This provides the user with all the power of a mainframe on his desk, while still offering the flexibility of a pc.

There are also specialist communications cards, modems, fax recievers and viatel terminals can all be implemented on a typical pc. Smartcard Australia (02-281-1911) sell a fax card, for instance for $2695.

Meanwhile the wheel has turned full circle. IBM no longer makes the PC, or any of its derivations, the XT or the AT. The division within IBM that was responsible for the basic design of the PC has disappeared, subsumed by the terminals division where they make the workstations that hang off the big IBM mainframes. Indeed, today IBM staffers use the words PC and workstation interchangeably, and its clear that big blue sees the future in terms of communications rather than stand alone computers.

Most industry pundits say that IBMs strategy now has been to develop a format that will beat the clones and the board makers out of existance, leaving it to dominate the market. This is unlikely to happen however. The public has had a taste of what compatibility means, and it likes it very much.

The problems that confront the industry today in terms of performance are not by and large hardware problems, but software related. There is, in fact, no need for a new pc. There is need for more powerful memory, and there is need for software that will utilize it better. But abandon the standard? Never. ●

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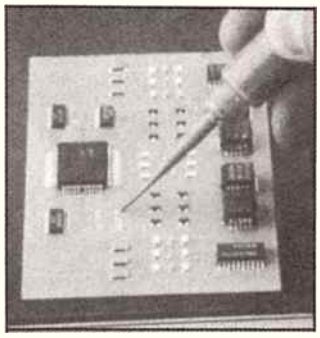
THE IREECON SHOW

There was a call from IREECON (the Institute of Radio and Electronic Engineers Convention) in Sydney in September for Australian industries to set up a standard for Biomedical Instrumentation. Australia leads the world in this technology and speakers argued the local industry should take a lead in directing its development.

During the week long convention, IREECON lived up to its reputation as a sounding board for the electronics industry. There were some noticeable absences from the line-up of companies, with several high flyers not turning up. But overall, a visitor to IREECON would have got a pretty good idea of what's moving the industry today.



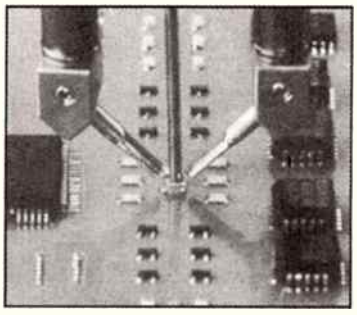
At the convention, most engineering interest centred on advances in data communications technology. LANs, optical fibres and satellites all received their fair share of air time. Also of considerable interest were the advances in microelectronics, mostly from the users point of view however. AWA, busy fitting up the latest fabrication line in the country at the moment, was surprisingly absent from the lists.

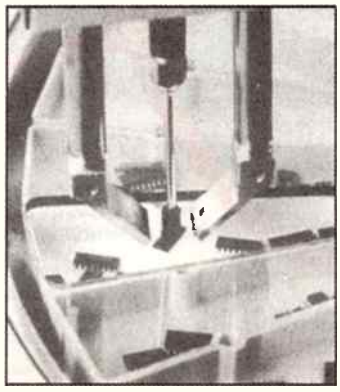
The exhibition which runs parallel to the convention, was even more a pretty good measure of whats happening in electronics at the moment. In contrast to the last IREECON in 1985, most people in the industry seemed very positive, talking up their wares and speculating on possible expansion of the industry.

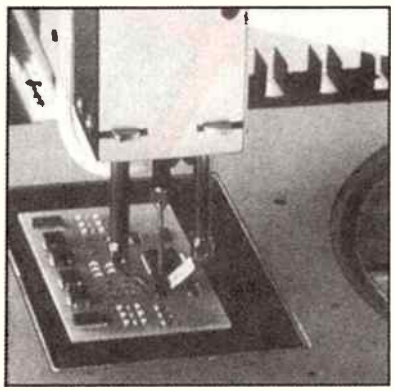
The most interesting looking exhibitors: surface mounting technology, digital broadcasting equipment, video graphics and effects generators. CD ROM also made an impact. One of the disappointments was the lack of any real input from the digital communications industry, in spite of the fact that digital communications was supposed to be the theme of the show. However, a number of optical fibre companies were present, so perhaps that made up for the balance.

Interesting products: Amid a plethora of pick n place machines and other devices to mount SMD devices one which stood out was Wella's PPS device for prototyping SMD boards. It consists of a vacuum sucker which can lift and deposit the packages accurately onto the board. There are two small hot air jets next to the sucker so that hot air can be used to melt the solder used to secure the component. The solder is deposited via a small dispenser prior to the component being replaced. According to Wella, the device makes it possible, for the first time, to prototype SMD units easily, and also to engage in a small scale manufacturing.

Mitsubishi was showing off their CDROM based car based satellite naviga-







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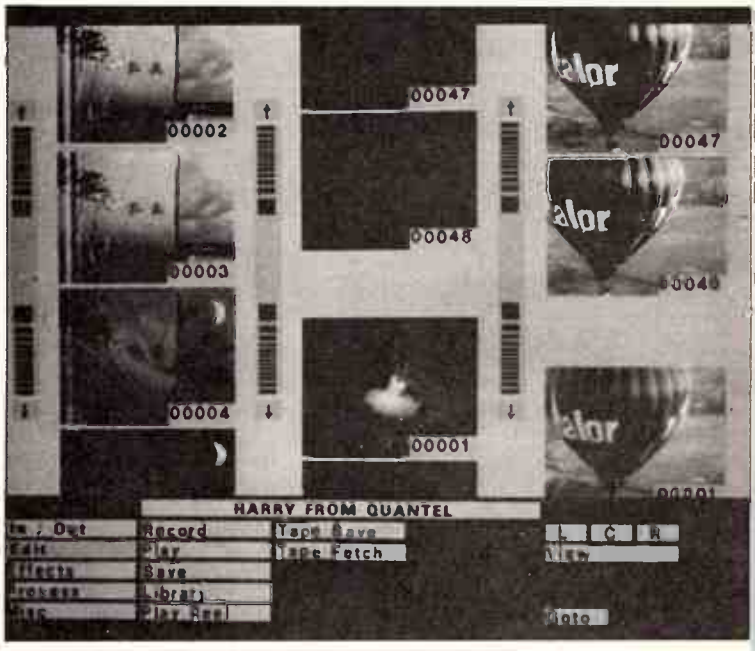
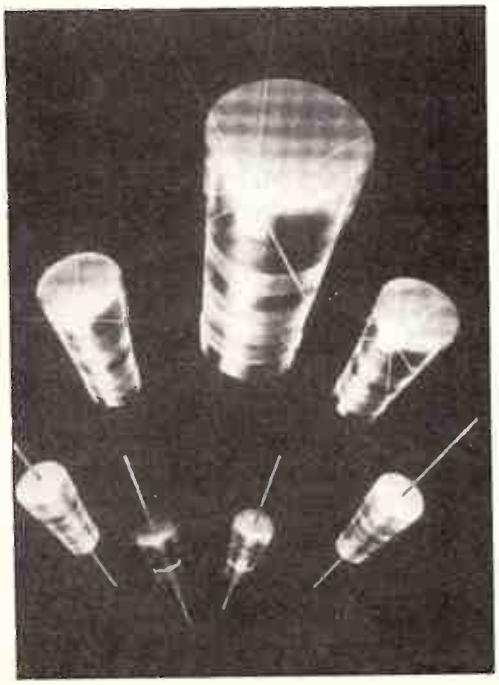
The IREECON Show





tion system. The device uses a small pancake aerial on the roof of the car to intercept signals for the GPS satellites, and so to derive the units position. Meanwhile an adaptor on the back of a standard CD player will allow information to be read from a CD ROM. The ROM contains map information. The two are then married together such that a map shows on a display on the car dash with a cursor to indicate current position. The whole system will be on sale "soon" for about $3000, according to Mitsubishi satellite systems engineer Jozef Gorup.

CD ROM was also on display at the Sony stand, where it was mounted in a pc and was being used to display Groliers encyclopedia, the first application to reach Australia. Sony also displayed a comprehensive list of digital broadcast and studio units, including their digital VTR. Sony's Robert Utheridge says two of these $300k machines have been sold in Australia, but wouldn't say who to.

Sony was only one of the many companies showing digital audio video equipment. Yamaha had the DMP7 digital mixing desk on display. This allows eight channels to be mixed under remote control by SMPTE timecode, MIDI or RS232. It's main claim to fame however, is that it takes analogue inputs, converts them into digital information and then does all its equilization and mixing digitally.

Also arousing much consumer interest were the latest generation of video processors from Bosch, Quantel and Abekas. The Bosch FGS 4000 has metamorphosed into the FGS 4500, with an Ethernet LAN and new shading software. The LAN enables a number of workstation to run off the one system. At $50k each they are expensive, but they do increase the production utility of the unit.

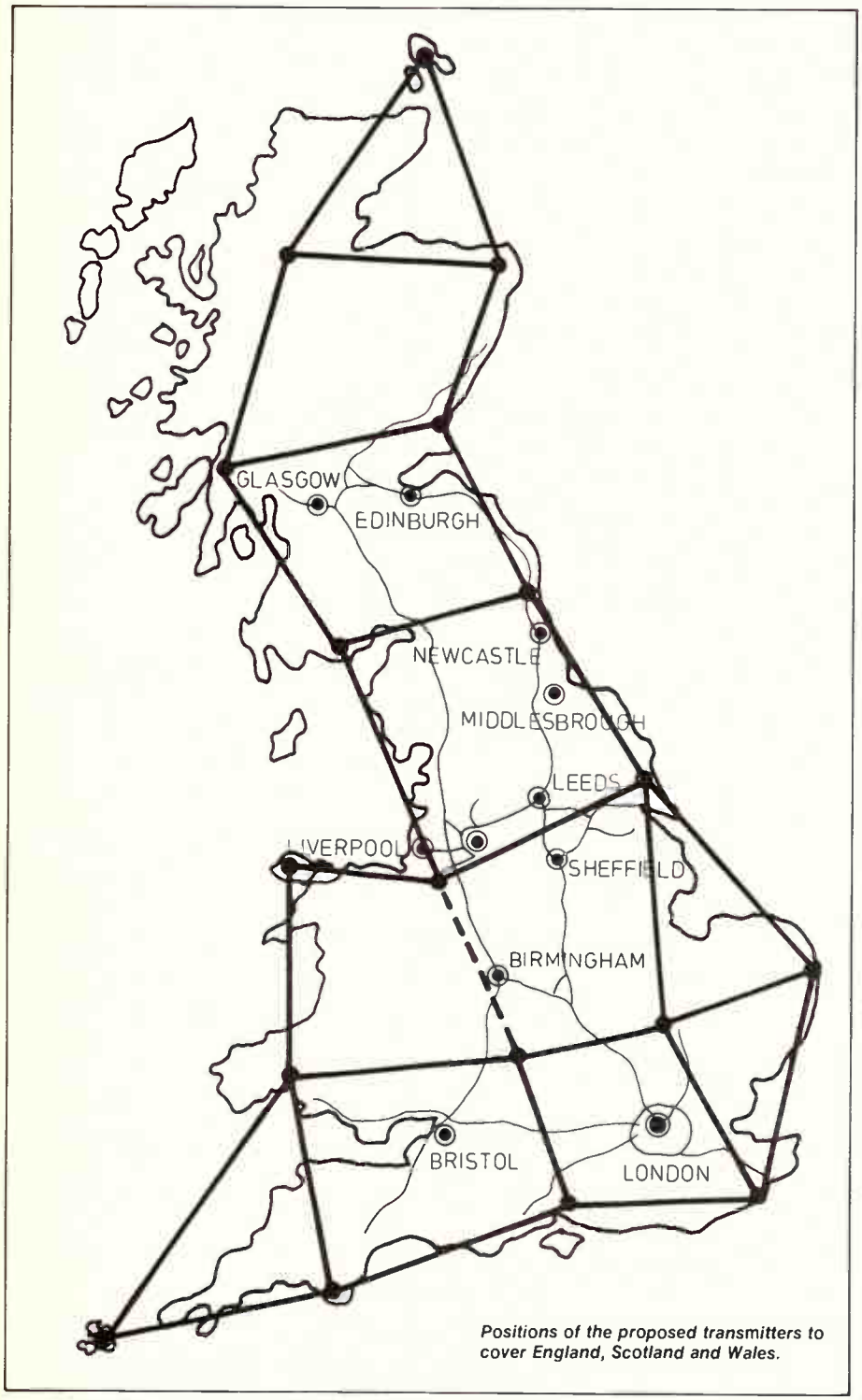
One of the most notable things about the exhibition was the small number of local manufacturers who were there. One of the major exceptions was Hobart based Component Resources, part of an umbrella group of companies that produce line conditioning, the ProtelCAD packages and now a Gerber photoplotter called the NovaTel. There were also a number of local hi-fi manufacturers, including Audiosound Laboratories and Murray Amplifiers. ●

Left, mini-melf SMD Resistors
Above left, the Uni-lab KG-107 mobile Radio
Far left, the IO Expander from Quantel

DATATRACK

At last, the technology of 007 is available to the average citizen

Robert Irwin



Positions of the proposed transmitters to cover England, Scotland and Wales.

The scenario should be familiar to all 007 fans. James Bond calmly climbs into the front seat of his Aston Martin as the bad guys wing it away in the black limo. No need to hurry as Bond flips the switch to activate the tracker. A screen comes alive on the dashboard and shows a street map of inner London with the villians position clearly marked by the flashing dot. Nothing to do now but sit back and sip a dry martini (shaken, not stirred) and wait for the baddies to lead him straight to their secret hideout.

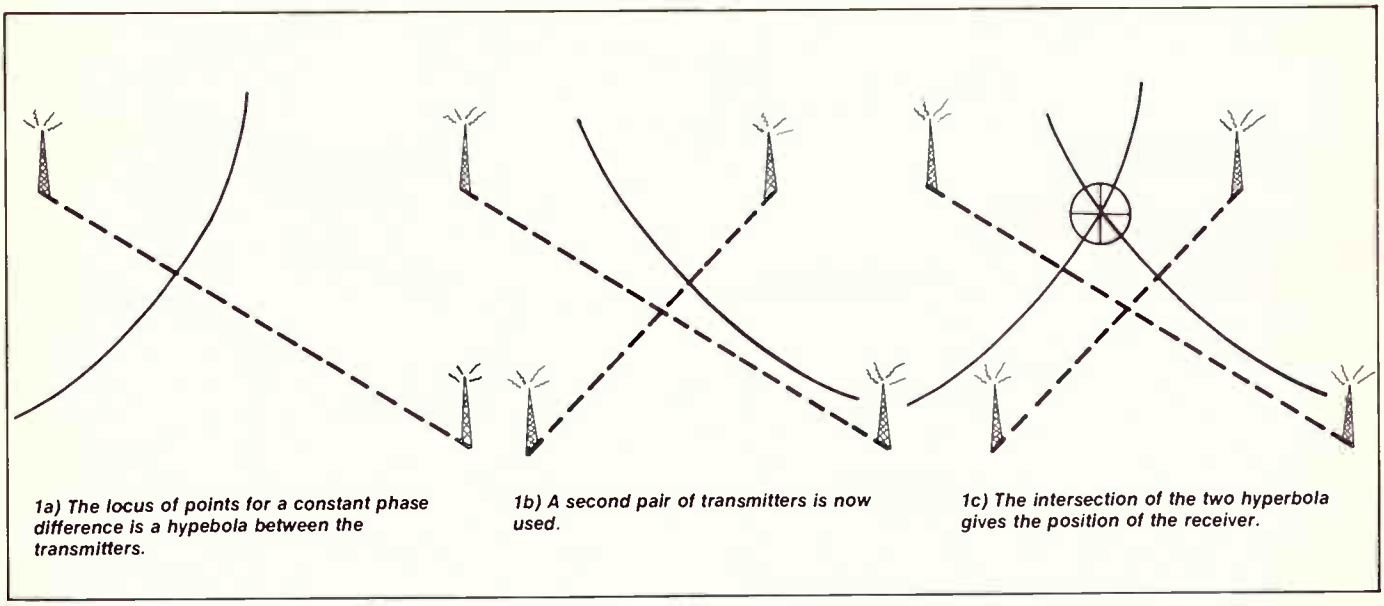
A big fanciful perhaps but in London recently this scene came a little closer to being a reality when the first phase of a unique land based tracking system was switched on and gave its users the ability to accurately track and monitor any suitably equipped moving object in the greater London area.

The system, called "Datatrak", is a comprehensive location and position reporting unit developed jointly by two British companies, Securicor Group and George Wimpey. It was primarily developed to keep track of high security vehicles or loads such as armoured cars or cars containing VIPs, etc. The aim was to produce a system capable of accurately locating a large number of objects simultaneously without the restriction of having to use external roadside sensors.

For this reason it was decided to base Datatrak on a radio hyperbolic system of position location.

Where Are You?

If you take a pair of radio transmitters and accurately synchronise their outputs then the relative distances from some arbitrary receiver to each transmitter can be worked out by examining the difference in time taken for the signals from each transmitter to reach the receiver. If the receiver is, for instance, an equal distance from each transmitter then the signals will arrive at the same time. If the receiver is closer to one transmitter then there will be a phase difference between the two incoming signals. The locus of points with a constant phase difference forms an hyperbola between the transmitters. (See Figure 1). If a different pair of transmitters synchronised to the first pair is now used then the receiver position will be given by the in-



1a) The locus of points for a constant phase difference is a hypebola between the transmitters.

1b) A second pair of transmitters is now used.

1c) The intersection of the two hyperbola gives the position of the receiver.

tersection of the two hyperbolae. The more transmitter pairs used the more accurate the position.

The Datatrak transmitters operate on two low frequency channels (130-140 kHz) and utilise time division multiplexing to differentiate between each other. Each has a power output of 1 kW and gives an effective radiation power of 30 watts from a 50 mm monopole aerial with top dressing. A wide area earth mat (using over 5 km of copper wire) is used to improve the efficiency. The range of these transmitters is conservatively rated at about 200 km which means that the whole of Britain can be covered with 18 transmitting stations. At present only three are operating and cover the greater London area. It is proposed to have eight transmitters on air by the end of this year to effectively cover all of southern England. The entire 18 are expected to be operational by mid '88.

Who Are You?

The Datatrak receiver or locator units is, in its present form, a briefcase size bundle of electronics which can be attached to any moving object you wish to track. The locator unit receives the signals from the transmitter pairs and works out its position as an unambiguous conventional ordnance survey grid reference. This information can either be displayed in the vehicle itself or transmitted along with the identity of the unit to a base station via a VHF radio link where it can be stored or displayed in the desired format.

As well as the position of a particular unit certain status information can also be sent. This information can either be driver initiated such as traffic conditions or an emergency alert, or can be automatically sent and give information on the status of any parameter of interest.

The system makes economical use of the airwaves and can accommodate up to 4500 locator units per channel and operates on a fixed time slot basis made possible by the accurate synchronising signals in the transmitters.

At present the locator hardware is made up from discrete off-the-shelf components but as development continues it is envisaged to make use of custom LSI chips to make the locator units much more compact. Eventually it should be possible to make the units small enough to be concealed in a briefcase or carried by individuals. This would be of great value in the protection of people under threat of kidnapping.

Although originally born from the need to improve operations of large fleets of security vehicles, Datatrak is sufficiently versatile to be configured for a great range of tracking requirements. A great deal of interest has apparently been shown by taxi companies who see Datatrak as a way of streamlining call procedures and increasing the security of drivers against robbery and violence. Datatrak could also be tailored, for instance, to give direct navigational and directional information to truck or coach drivers by way of in-vehicle electronic map displays and route indicators (enter 007!). The system is not even limited to the land. Any shipping on rivers or in coastal waters or any small low flying aircraft could make use of the system as well.

Tracking Britain

In mid '88 when the final transmitters are turned on it will mean that any object equiped with a locator unit can be accurately tracked anywhere in Great Britain and its coastal waters paving the way for more efficient and secure transport systems than has been possible in the past. Imagine being able to ring for a taxi late on a Saturday night and being given an accurate waiting time and not just some arbitrary number of minutes chosen to placate your pleadings for haste. Sounds like science fiction doesn't it? If Datatrak has its way it should soon be possible. And if things go well in Britain perhaps the future sees the whole of Europe linked in to the navigational network. These and other plans are definitely in the pipeline.

As 007 sits back in his Aston Martin casually watching the dot an the screen wind its way along the back streets of London he castes his mind back to the days before Datatrak when the only way to "follow that car" was the dramatic car chases so loved by those television cop shows. Perhaps a slight sigh passes his lips . . . ●

Robert Irwin is a former ETI engineer now resident in Britain

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SPECIAL, ONLY $399
SAVE $50

[illegible] developed by [illegible] ELECTRONICS and is being supplied to other kit suppliers.

SPECIFICATIONS: 150 W RMS into 4 ohms (per channel)
POWER AMPLIFIER: 100W RMS into 8 ohms (• 55V Supply)
FREQUENCY RESPONSE: 8Hz to 20Hz +0 0 4 dB 2 8Hz to 65KHz, +0 3 dB. NOTE These figures are determined solely by passive filters
INPUT SENSITIVITY: 1 V RMS for 100W ouput
HUM: 100 dB below full output (flat).
NOISE: 116 dB below full output (flat, 20KHz bandwidth)
2nd HARMONIC DISTORTION: 0 001% at 1 KHz (0 0007% on Prototypes) at 100W ouput using a + 56V SUPPLY rated at 4A continues 0 0003% for all frequencies less than 10KHz and all powers below clipping
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STABILITY: Unconditional

Cat. K44771 ..... $449
Assembled and tested $599
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- 1% Metal F[illegible]

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[illegible] believe that dollar for [illegible] commercial unit available that sounds as [illegible]

SPECIFICATIONS:
FREQUENCY RESPONSE: High-level input 15Hz 130KHz, +0 1dB Low-Level input-conforms to RIAA equalisation + 0 2dB
DISTORTION: 1KHz 0 003% on all inputs (limit of resolution on measuring equipment due to noise limitation)
S/N NOISE: High-Level input, master full, with respect to 300mV input signal at full output (1 2V) 92dB flat 100dB A-weighted. MM input, master full, with respect to full output (1 2V) at 5 mV input 500ohms source resistance connected 86dB flat/92dB A-weighted MC input, master full, with respect to full output (1 2V) and 200uV input signal 71dB flat 75dB A-weighted

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(Approximately 4 weeks delivery)

Errors and Ommissions Excepted

PARABOLIC MICROPHONE

Build a low cost parabola, along with a high gain headphone amplifier to help when listening to those natural activities such as babbling brooks, singing birds or perhaps even more sinister noises. The current cost of componenets for this project is around $15 including sales tax, but not the cost of batteries or headphones (EA Nov '83) 83MA11

Cat K83110 **$14.95**

1W AUDIO AMPLIFIER

A low-cost general-purpose 1 watt audio amplifier, suitable for increasing your computers audio level, etc (EA Nov '84)

Cat **$9.95**

EA AM STEREO DECODER

AM stereo is now broadcast in Australia on an experimental basis. This add-on decoder works with the Motorola C-QUAM system (EA Oct '84) 84MS10

Cat K84100 **$26.95**

PLAYMASTER 300 WATT AMPLIFIER

This module will deliver up to 200 watts into an 8 ohm load and up to 300 watts into a 4 ohm load. Comprehensive protection is included and a printer circuit board brings it all together in a rugged easy-to-build module. It can be built in either fully-complemetary or quasi-complementary versions, so output transistor shortages should be no problem at all! (80PA6) (EA July 80)

Cat K80060 **Normally $109**
SPECIAL, ONLY $99
(Heatsink not included)

SERIES 4000 STEREO PREAMP

This high performance project is designed to complement ETI's 60 watt low distortion amplifier module and forms part of a complete stereo system, the "Series 4000" project (ETI 471)
(Top Projects Vol 6)

Cat K44710 **$59.95**

GENERAL PURPOSE PREAMPLIFIER

A general purpose stereo preamplifier using a single LM382 IC which can be tailored for use with magnetic pickups, tape recorders or microphones by changing a few components (ETI445) (ETI July 76)

Cat K44490 **$9.95**

OP AMP TESTER

The Op Amp Tester which could save you hours in agonising whether that old op amp thats been sitting in the draw for the last year
(ETI Apnl '85, ETI 183)

Cat K41830 Normally $26 50
SPECIAL, $21.50

150W MOSFET POWER AMPLIFIER

Here's a high power, general purpose 150W Mosfet Power Amp Module! Suitable for guitar and P A applications and employing rugged, reliable Mosfets in the output stage (ETI 499) (ETI March '82)

Cat K44990 **$97.50**
(Heatsink not included plus transformer $49.50

SUPERB VIFA/EA 60+60 SPEAKER KIT!

The Vifa/EA 60+60 loudspeaker kit has been designed to completely out perform any similarly priced speakers. This is a 2-way design incorporating drivers which give a deeper, more natural bass response and 19mm soft-dome ferro fluid cooled tweeters which provide clear, uncoloured sound reproduction.

These Vifa drivers are identical to the ones used in such fine speakers as Mission, Rogers, Bang & Olufsen, Monitor Audio and Haybrook just to name a few. Some of which cost well over $1,000 a pair!

The dividing network is of the highest quality and produce no inherent sound characteristics of their own, they simply act as passive devices which accurately distribute the frequency range between both drivers in each speaker.

The fully enclosed acoustic suspension cabinets are easily assembled. All you need are normal household tools and a couple of hours and you've built yourself the finest pair of speakers in their class!

D19 TWEETER SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 2 5 - 20KHz
Free Air Resonance: 1,700Hz
Sensitivity 1W at 1m: 89dB
Nominal Power: 80 Watts (to 5,000Hz, 12dB/oct)
Voice Coil Diameter: 19mm
Voice Coil Resistance: 6 2 ohms
Moving Mass: 0 2 grams
Weight: 0 28kg
Cat C10301 **$38**

C20 WOOFER SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 35 - 6,000Hz
Resonance Frequency: 39Hz
Sensitivity 1W at 1m: 90dB
Nominal Power: 50 Watts (12dB/oct)
Voice Coil Diameter: 25mm
Voice Coil Resistance: 5 5 ohms
Moving Mass: 15 grams
Cat C10322 **$89**

Cat K86092 (speakers only) **$379**
Cat K86091 (complete kit) **$449**

MIDRANGE HORNS

Use these quality, all metal, Piezo tweeters for great top end sound in your band speakers, disco sound system, etc. Rated at 30 watts RMS in a system they will handle over 100 watts RMS
Two sizes to choose from:
Size: 4" x 10 1/2"
Impedance: 8 ohms
Rating: 30 watts RMS
Response: 1 5kHz - 14 kHz
Dimensions: 102 x 267 x 177mm
Cat C92082 **Normally $49.95**
This month only $39.95

Size: 3" x 7"
Impedance: 8 ohms
Rating: 30 watts RMS
Response: 2kHz - 15 kHz
Dimensions: 76 x 177 x 145mm
Cat C92084 **Normally $29.95**
This month only $24.95

Dealers, OEM's, etc., phone (03) 543 2166 for wholesale prices

50 W AMPLIFIER MODULE (ETI 480)

Cat K44880 **$31.80**
(Heatsink optional extra)

100 W AMPLIFIER MODULE (ETI 480)

Cat K4480[illegible] $34.80
(Heatsink optional extra)

OMNI-DIRECTIONAL WIRELESS MICROPHONE

Tuneable: 92 - 104MHz
Freq. Response: 50 - 15kHz
Range: Over 300 feet in open field
Modulation: FM
Power Source: 9V Battery
Type: Electret Condenser
Dimensions: 185 x 27 x 38mm
Weight: 160 grams
Cat A10450 **$19.95**

2¼" MINI SPEAKERS (57mm)

Cat.No.	1-9	10+
C10610	$1.95	$1.75

SUPER HORN

- Wide dispersion tweeter, handles up to 100W
- Sensitivity 105dB/0 5m
- Frequency Response 3kHz-30kHz
- Impedance 8 OHMS
- Size 145x54mm

Cat C12103 **Normally $12.95**
SPECIAL, ONLY $9.95

SUPER HORN TWEETER

- Requires no crossover and handles up to 100W†
- Sensitivity 100dB/0 5m
- Frequency Response 3kHz-30kHz
- Impedance 8 OHMS
- Size 96mm diameter

Cat C12102 **Normally $12.95**
SPECIAL, ONLY $9.95

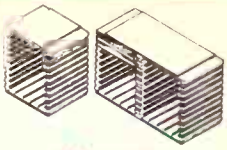
PHILIPS SPEAKERS

Unfortunately we cannot always guarantee Philips speakers to be in stock due to availability problems, nor can we guarantee the exact models listed. However, Philips equivalent or better will be supplied. -Rod

Description	Cat.No.	Price
AD01610T8	(C12030)	$24.95
AD02160SQ8	(C12040)	$69.95
AD80652W8	(C12042)	$69.95
AD070620M8	(C12045)	$69.95
AD12250W8	(C12050)	$129.00

PIEZO DIRECT RADIATING TWEETER

Requires no crossover, handles up to 100 watts
Sensitivity: 98dB
Maximum input: 24 volts
Freq. Response: 3 2 - 30kHz
Dimensions: 95mm diameter
Cat C12104 **$11.95**



COMPACT DISC STORAGE UNITS

- Holds 10/20 compact discs in their cases
- Interlocking modular design allows vertical and horizontal interlocking
- Discs slide into place horizontally making titles easy to read
- Wall mount or free standing.

A10031 (10 discs) **$12.95**
A10032 (20 discs) **$19.95**

ROTATING LIGHT

Motor driven rotating reflecting mirror with a flash rate of about 150 per minute. Large lens fit right to base, making unit weatherproof. Spare globe included

SPECIFICATIONS:
- Available in Blue or Orange
- 150 Revolutions per minute (approximately)
- Shock absorbing rubber mounting legs
- Connecting wire fitted through base
- 12V DC 750mA
- Base diameter 102mm Height 140mm

A15042 Blue **$42.95**
A15043 Orange... **$42.95**

CRYSTAL LOCKED WIRELESS MICROPHONE AND RECIEVER

MICROPHONE SPECIFICATIONS:
Transmitting Frequency: 37 1MHz
Transmitting System: crystal oscillation
Microphone: Electret condenser
Power Supply: 9V battery
Range: 300 feet in open field
Dimensions: 185 x 27 x 38mm
Weight: 160 grams

RECIEVER SPECIFICATIONS:
Recieving Freq: 37 1MHz
Output Level: 30mV (maximum)
Recieving System: Super heterodyne crystal oscillation
Power Supply: 9V Battery or 9V DC power adapter
Volume control
Tuning LED
Dimensions: 115 x 32 x 44mm
Weight: 220 grams

Cat A10452 **R.R.P. $113**
Our price, $99

WIRELESS MICROPHONE RECEIVER WA100

Made by Piezo (Azden) of Japan, this device will turn any microphone fitted with a Cannon Type male socket into a wireless microphone. The receiver will plug into any 6 35mm microphone input. Both transmitter and receiver can be tuned from 76 - 81MHz
Freq. Response: 50 - 16kHz
Tunable: 76 - 81MHz
Field Strength:
Transmitter 10uV/100 metres
Receiver 15mV (100%)
Battery: Transmitter LR44 (1 5V)
Receiver 3 x UM4 (4 5V)
Instructions: Japanese (English not available!)

Cat A10520 **R.R.P. $199**
Our price only $189

3M DYNAMARK PHOTOSENSITIVE
(EX SCOTCHCAL)

All prices per box and include tax

8007 REVERSAL FILM
250 x 300mm (10 sheets) $39.95
300 x 600mm (5 sheets) $54.95

8005 BLACK ALUMINIUM
250 x 300mm (10 sheets) $69.95
300 x 600mm (5 sheets) $79.95

8009 BLUE ALUMINIUM
250 x 300mm (10 sheets) $69.95
300 x 600mm (5 sheets) $79.95

8011 RED/WHITE
250 x 300mm (10 sheets) $64.95
300 x 600mm (5 sheets) $74.95

8013 BLACK/YELLOW
250 x 300mm (10 sheets) $64.95
300 x 600mm (5 sheets) $74.95

8015 BLACK/WHITE
250 x 300mm (10 sheets) $64.95
300 x 600mm (5 sheets) $74.95

8016 BLUE/WHITE
250 x 300mm (10 sheets) $64.95
300 x 600mm (5 sheets) $74.95

8018 GREEN/WHITE
250 x 300mm (10 sheets) $64.95
300 x 600mm (5 sheets) $74.95

CRYSTALS SPECIALS!

Description	Cat.No.	1-9	10+
1MHz	Y11000	$7.50	$7.00
4.433618MHz	Y11023	$2.95	$2.75
8.867238MHz	Y11055	$2.95	$2.75
12MHz	Y11070	$2.95	$2.75
14.31818MHz	Y11072	$2.95	$2.75

NICADS!
Save a fortune on expensive throw away batteries with these quality Nicads and Rechargers!

Size	Desc.	1-9	10+	100+
AA	450 mA H	$2.95	$2.75	$2.50
C	1 2 A H	$9.95	$9.50	$8.95
D	1 2 A H	$9.95	$9.50	$8.95

COMPUTER CABLE

CIC5 5 conductor computer interface cable Colour coded with braided shield (to IE422 specifications) Copper conductor 6 x 7/0 16mm
1-9 metres $1.90/m
10+ metres $1.70/m

CIC9 9 conductor computer interface cable Colour coded with mylar shielding 9 x 7/0 16mm
1-9 metres $2.50/m
10+ metres $1.95/m

CIC12 12 conductor computer interface cable Colour coded with mylar shielding 12 x 7/0 16mm
1-9 metres $2.70/m
10+ metres $2.50/m

CIC16 16 conductor computer interface cable Colour coded with mylar shielding 16 x 7/0 16mm
1-9 metres $3.90/m
10+ metres $3.40/m

CIC25 25 conductor computer interface cable Colour coded with mylar shielding 25 x 7/0 16mm
1-9 metres $4.90/m
10+ metres $4.40/m

DB25 CONNECTOR SPECIALS!
We have just imported 50,000 So you get to save a small fortune!

DB25 MALE (P10900)

1-9	10+	100+
$1.00	$0.90	$0.80

DB25 FEMALE (P10901)

1-9	10+	100+
$1.20	$1.00	$0.90

IC SPECIALS!

8087 CHIPS!
8087-3 (4.77MHz) $269
8087-2 (8MHz) $385
8087-1 (10MHz) $585
80287-6 (6MHz) $475
80287-7 (8MHz) $679

SPO256A-AL2 SPEECH CHIP
Speech synthesiser chip, needs programming to work.

1-9	10+	100+
$15.00	$14.50	$14.00

CTS256-AL2 SPEECH CHIP
Contains the code recognition circuit to enable the project to plug directly on to the printer port, or into an IBM PC.

1-9	10+	100+
$27.00	$26.50	$26.00

AM/EF 7910
(WORLD MODEM CHIP)

1-9	10+
$19.95	$17.95

41256-15

1-9	10+	100+
$7.95	$6.95	$5.95

4164

1-9	10+	100+
$3.95	$2.95	$2.75

27128

1-9	10+	100+
$9.95	$8.95	$7.95

27512

1-9	10+	100+
$19.50	$18.50	$17.50

6116 LP-3
(150ns)

1-9	10+	100+
$3.95	$3.75	$3.50

NE5534AN

1-9	10+	100+
$1.95	$1.85	$1.75

6264

1-9	10+	100+
$7.95	$6.95	$6.50

2732

1-9	10+	100+
$8.95	$8.50	$7.95

CA3130E

1-9	10+	100+
$1.95	$1.75	$1.50

INS8250

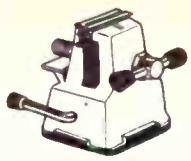
1-9	10+	100+
$29.95	$27.95	$26.95

ZN429

1-9	10+	100+
$7.95	$7.50	$6.95

ADC0820

1-9	10+	100+
$24.95	$22.95	$20.95



MINIATURE HOBBY VICE
- Lever operated suction grip base for instant mounting and portability
- Mounts on smooth non-porous surfaces
- Ideal for holding components, and other small/light objects

Cat.T12458 ... only $5.45

CODE KEY PAD
- Telephone type digital keypad
- Four digit, changeable code.
- Over 5000 possible combinations
- Power consumption 5mA standby, 50mA alarm
- Two sector LED and 1 arm LED
- Wrong number lockout
- 12V DC operation
- Relay output
- Panic button
- Normally open tamper switch
- Dimensions 145 x 100 x 37mm
- ACP3 compatible

Cat A13014 R.R.P. $79.95
SPECIAL, ONLY $69.95

NEW!

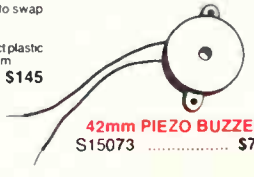
RS232 FAST CABLER
Makes RS232 interface configurating fast and simple. 3 slide switches enable line swapping functions, positive and negative voltages are displayed on 6 tricolour LED's

SPECIFICATIONS:
Connector: DB25 plug on 100mm cable and DB25 socket on 100mm cable
Indicators: Tricolour LED's for pins 2(TD), 3(RD), 4(RTS), 5(CTS), 6(DSR) 20(DTR)
Switches: 3 Slide switches to swap leads
Power: Interface power
Enclosure: Black, high impact plastic
Dimensions: 85 x 95 x 30mm

X15710 ..... $145

AUTOMATIC CABLE STRIPPER
- Strips cable with diameter of 1.16 2.26 3.2mm
- Fully automatic action. Squeeze grip will simulataneously strip and eject insulation
- Length 180mm (7")

T11532 ..... $19.95



42mm PIEZO BUZZER
S15073 ..... $7.95

½" HIGH INTENSITY RED LED DISPLAYS
(Available in Common Cathode and Common Anode)

Dimensions:
Overall 12.7mm across, 19mm high
Display 12.7mm(H) x 7.3mm(W)
Segment Width 1.2mm
Brightness 3400 ucd I_F = 10mA

COMMON CATHODE:
Pin 1 Segment E Pin 6 Segment B
Pin 2 Segment D Pin 7 Segment A
Pin 3 CC Pin 8 CC
Pin 4 Segment C Pin 9 Segment F
Pin 5 Segment Dp Pin 10 Segment G

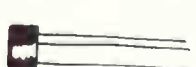
Cat No	1-9	10+	100+
Z10190	$1.95	$1.75	$1.50

HIGH INTENSITY RED LED BAR GRAPH
Dimensions:
Overall 63mm across, 5mm high
LEDs 10 x 5mm x 1mm

Cat No	1-9	10+
Z10180	$2.95	$2.75

COMMODORE EDGE CONNECTOR
156" spacing, 12/24 contacts

Cat No	1-9	10+
P10973	$5.95	$4.95

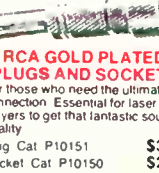


BRIDGE SPECIALS

1-9	10+	100+
WO2 1A 200V Cat Z11030		
$0.30	$0.28	$0.26
WO4 1A 400V Cat Z11032		
$0.35	$0.30	$0.28
SB604 6A 400V Cat Z11034		
$0.90	$0.80	$0.75

SPECTROL 64Y MULTI TURN TRIMPOTS

Cat No	Description	1-9	10+
R14700	10R	$3.50	$3.20
R14710	20R	$3.50	$3.20
R14720	50R	$3.50	$3.20
R14730	100R	$3.50	$3.20
R14740	200R	$3.50	$3.20
R14750	500R	$3.50	$3.20
R14760	1K	$3.50	$3.20
R14770	2K	$3.50	$3.20
R14780	5K	$3.50	$3.20
R14790	10K	$3.50	$3.20
R14800	20K	$3.50	$3.20
R14810	50K	$3.50	$3.20
R14820	100K	$3.50	$3.20
R14830	200K	$3.50	$3.20
R14840	500K	$3.50	$3.20
R14850	1M	$3.50	$3.20



10 AMP RELAY
S P D T 12V Coil, 240V (S14114)

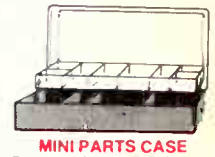
1-9	10+	100+
$4.95	$3.95	$3.75

RCA GOLD PLATED PLUGS AND SOCKETS
For those who need the ultimate in connection. Essential for laser disc players to get that fantastic sound quality

Plug Cat P10151 $3.75
Socket Cat P10150 $2.95

RCA GOLD PLATED CHASSIS SOCKET
For the ultimate connection!

Cat	1-9	10+	100+
P10229	Normally $1.95		
	$1.00	$0.90	$0.85



MINI PARTS CASE
Features a clear plastic lid for easy identification of contents. Up to five, adjustable lower compartments, plus a self elevating upper tray for smaller items.
Dimensions 110 x 210 x 43mm
Cat. H10087 ..... $9.95

CANNON TYPE CONNECTORS SPECIALS

Cat. No.	Description	Price
P10960	3 pin line male. Was $3.90	NOW $2.90
P10962	3 pin chasis male Was $3.00	NOW $2.40
P10964	3 pin line female Was $4.50	NOW $3.25
P10966	3 pin chasis female Was $4.95	NOW $3.45

SPRING RETURN TOGGLE SWITCHES

		WAS	NOW
S P D T	Cat S11012	$2.25	$1.95
D P D T	Cat S11022	$2.50	$2.25

BARGAINS!

SPECTROL MULTIDIALS MODEL 15-1-11
Number of turns: 10
Minor Scale Division: 1/500 turn
Shaft Bore: 6.35mm (1/4")
Finish: Satin Chrome
Body Size: 25.4 x 44.45mm (1 x 1 3/4")
Depth: 25.4mm (1")
Weight: 45.4g (1.6oz)
Cat.R14405 ..... $45.95

MODEL 16-1-11
Number of turns: 15
Minor Scale Division: 1/50 turn
Shaft Bore: 6.35mm (1/4")
Finish: Clear Anodize
Body Size: 22.2mm diameter (.875")
Depth: 22.2mm (.875")
Weight: 19.8g (0.7oz)
Cat.R14400 ..... $26.95

MODEL 21-1-11
Number of turns: 15
Minor Scale Division: 1/100 turn
Shaft Bore: 6.35mm (1/4")
Finish: Satin Chrome
Body Size: 46.04mm diameter (1.812")
Depth: 25.4mm (1")
Weight: 85g (3oz)
Cat.R14410 ..... $46.95

10 TURN WIRE WOUND POTENTIOMETER
Spectrol Model 534
¼" shaft.
Equiv (Bourns 3540S, Beckman 7256)
Dials to suit 16-1-11, 18-1-11, 21-1-11

R14050	50R	R14100	5K
R14055	100R	R14110	10K
R14060	200R	R14120	20K
R14070	500R	R14130	50K
R14080	1K	R14140	100K
R14090	2K		

1-9	10+
$13.50	$12.50

QUALITY LEDS

Cat. No.	Description	Price
Z10140	3mm Red	$0.15
Z10141	3mm Green	$0.20
Z10143	3mm Yellow	$0.20
Z10145	3mm Orange	$0.20
Z10150	5mm Red	$0.15
Z10151	5mm Green	$0.20
Z10152	5mm Yellow	$0.20

SOLDER BRAID
1.5 metres of specially treated braid for removing solder from PCB's etc Simply place the braid against the solder and apply the soldering iron The melted solder is drawn up into the braid!
T11320 1.5 metres $1.95

CENTRONICS PLUG SPECIAL!
36 WAY MALE (P12200)

1-9	10+	100+
$3.95	$3.50	$3.00

VOLTAGE REGULATORS BARGAINS

Description	1-9	10+
7805UC	$0.60	$0.50
7812UC	$0.60	$0.50
7905UC	$0.60	$0.50
7912UC	$0.60	$0.50

SPRING RETURN TOGGLE SWITCHES

		WAS	NOW
S P D T	Cat S11012	$2.25	$1.95
D P D T	Cat S11022	$2.50	$2.25

Rod Irving Electronics
48 A'Beckett St, MELBOURNE
Phone (03) 663 6151
425 High St, NORTHCOTE
Phone (03) 489 8866
Mail Order and Correspondence
P.O. Box 620, CLAYTON 3168
Telex: AA 151938
Fax: (03) 543 2648

MAIL ORDER HOTLINE
008 335757
(TOLL FREE)
(STRICTLY ORDERS ONLY)

LOCAL ORDERS & INQUIRIES (03) 543 7877

POSTAGE RATES.

$1	$9.99	$2.00
$10	$24.99	$3.00
$25	$49.99	$4.00
$50	$99.99	$5.00
$100	$199	$7.50
$200	$499	$10.00
$500 plus		$12.50

The above postage rates are for basic postage only. Road Freight, bulky and fragile items will be charged at different rates.

All sales tax exempt orders and wholesale inquiries to RITRONICS WHOLESALE, 56 Renver Rd, Clayton Ph (03) 543 2166 (3 lines)

Errors and omissions excepted

MasterCard VISA

ASTRA — EUROPE'S HOT-BIRD TV SATELLITE

An Australian doctor, a Luxembourg consortium and a French rocket have created new waves in European broadcasting.

LIZ FELL

Since 1985, Australian engineer, Dr John Tydeman, has travelled to the Grand Duchy of Luxembourg once a month to provide technical and marketing advice on a daring new pan-European satellite TV venture.

Tydeman is one of the team developing Astra, a privately-owned satellite with 16 medium-power (45 watt) transponders designed specifically for beaming multi-channel, multi-lingual TV entertainment into European homes.

"Astra is an interesting, stimulating, exciting, satellite designed only for TV services . . . and lots of them. The Europeans call it a hot-bird," said Dydeman, with obvious enthusiasm, adding that "hot" means "groovy" in European parlance.

"At the moment, we're planning a TV receive-only dish (TVRO) as small as 65 cm in the middle of Astra's footprint where there is 50 dBW reception."

Tydeman is also hoping that the cost of a domestic TVRO — including the encoder, low-noise amplifier and tuner/receiver — will be as low as UK £150-200 though, "we all know about manufacturers and their prices".

Other distribution methods of Astra's TV customers will be through European

cable operators or satellite master antennae TV (SMATV) systems located on top of community dwellings such as large apartment blocks.

Tydeman is no novice to the satellite business. Before branching out on his own, he worked on direct broadcasting satellite (DBS) projects in the United States for Murdoch's News Corporation.

When Murdoch pulled out of these projects, Tydeman moved to the United Kingdom and became involved in Murdoch's acquisition and marketing of Sky Channel, the first satellite-delivered pan-European TV service to cable operators.

In 1985, he returned to Australia to establish his own company, Electronic Publishing and Marketing. Soon after, he was invited to become executive adviser to the remote commercial TV company, Satellite South-East, which is planning to take up capacity on Aussat.

Even though his base is now Australia, he manages to maintain his links to Europe through SES — La Societe Europeenne des Satellites — the private Luxembourg company that has funded, designed and developed the Astra TV satellite.

Luxembourg's Initiative

Astra was the brain-child of the Luxembourg government. Recognising that a satellite designed exclusively for the tiny population of 350,000 was out of the question, the government pursued the concept of a pan-European satellite reaching a potential TV audience of 355 million.

In April 1986 it put out "feelers" to some of the major banks and corporations based in Luxembourg. The institutions took up the idea and established a private company with seed money to assess the market. Now the first Astra satellite, built by the US aerospace company General Electric, is set for launch on an Arianespace rocket in September or October next year.

Establishing a privately-owned European satellite has obviously been a daunting and controversial task. The first major hurdle was coordination with Eutelsat, the regional satellite organisation formed to act on behalf of Europe's telecommunication administrations (PTTs).

"Initially Eutelsat was very hostile to the idea of a private system," Tydeman explained. "It believed that all its member PTT's supported the argument that Astra would cause significant economic harm to Eutelsat's own system."

SES pressed ahead arguing that Eutelsat's low-power satellites served a different market. After more than 18 months of lobbying and negotiations, Tydeman now expects Eutelsat members to give the green light to Astra "any day".

Competition

The European satellite TV market is still developing, so Tydeman is confident there is a market niche for Astra. The major competition comes from a new Franco-German DBS system comprising two powerful "twin" satellites — TDF-1 and TV-SAT.

If Arianespace satellite launches proceed on schedule, these twin satellites should be up in the sky in the next six months — just before Astra. Each satellite has capacity for four direct broadcast TV services, so Tydeman doesn't see this or any similar system as a threat to Astra's plan to transmit 16 services from one medium-power satellite.

Another reason for his calm in the face of competition is that the original aim of the Franco-German project was to provide

domestic TV coverage for France and Germany, though some "spill" across national borders was always anticipated.

Tydeman outlined how TV-SAT, the German satellite owned by the Deutches Bundespost, had allocated two transponders to entertainment channels which are already distributed terrestrially to households in Germany.

The other two transponders are to be used by German public broadcasters "both of which put out cultural BBC/ABC/SBS type programming which doesn't ever get very high ratings". TV-SAT is a "terribly uninteresting satellite because two of the four transponders are basically non-commercial," he concluded.

Meanwhile, planning for the twin TDF-1 satellite is a "shambles", according to Tydeman, and Telediffusion de France is now asking broadcasters to provide investment funds in addition to purchasing transponder capacity.

Penetrating markets

Tydeman believes that Astra is headed for success in the European market, partly because "British Telecom and Astra have signed a joint venture agreement which involves British Telecom marketing up to 11 of Astra's 16 transponders to English-language programmers."

At present, British Telecom has the UK monopoly for up-linking satellite-delivered TV to European cable operators using systems such as Intelsat, so Astra is hoping to secure some of British Telecom's English-language customers.

The strategy is to offer programmers penetration in all possible European TV markets. "We will provide access to cable operators — which receive programmes off low-power satellites already — plus access to 29 million SMATV households, as well as the evolving direct reception market," Tydeman explained.

He then listed about 11 potential English-language satellite customers who distribute TV via British Telecom to the continent: Sky Channel, Super Channel, Arts Channel, Screensport, Children's Channel, Premiere, plus US services such as Cable news Network (CNN), and the US Information Agency's World Net.

"Because Astra has 16 transponders and therefore 16 services, we expect people to say 'Gosh . . . we should have a satellite dish to look at Astra'".

"Of course," he added, "British Telecom is a member of Eutelsat so we hope it will give Astra the support it needs to finish the coordination procedure with Eutelsat." This is one reason why Tydeman is so certain that Astra will receive the go-ahead soon.

The MAC Debate

Astra has also experienced problems because of the on-going dispute over a European TV transmission and encryption standard. While most European nations agree on MAC technology (multiplexed analogue components), there is no agreement on which type of MAC should be used.

The Franco-German DBS group has supported the D2-MAC system which will allow broadcasters to distribute up to four high-quality audio signals with each TV signal. Meanwhile, the Scandinavians have started testing C-MAC technology.

Then there are British TV programmers such as Screensports and the Children's Channel which favour a variation called D-MAC, while a second British group offering a Satellite Racing service is actually using B-MAC — Australia's transmission standard.

Another recent addition to the British

scene is the UK DBS franchisee, British Satellite Broadcasting (BSB), in which Australian Alan Bond, has a major shareholding. "BSB hasn't taken a position yet, so everyone is lobbying it for a commitment to B-MAC or D-MAC or D2-MAC or whatever," Tydeman commented wryly.

Since the French and West German direct broadcasting satellite projects will be launched first, D2-MAC will probably win the day. "But its the classic problem — the industry still hasn't produced any D2-MAC equipment," he observed.

Another dispute has arisen over the determination of a European conditional access or encryption standard. "This becomes much more important for those programmers planning to embark on satellite-delivered Pay TV and Pay-Per-View TV," said Tydeman.

While the MAC technology provides a means of encryption, the major problem is that D2-MAC conditional access hasn't been developed yet, and "we all know the time-frame to develop encryption is substantial."

Meanwhile, the "Scandinavians are actually working towards a chip-set which incorporates C-MAC, D-MAC and D2-MAC. They're also now talking about building a TV set with the MAC component inside the set.

"They've even got an extended MAC — E-MAC — which is supposed to be available for high definition TV. One of the things they're thinking about now, is the path from D2-MAC, which doesn't even exist, to E-MAC which will be compatible with High Definition TV."

Given all these MAC systems, what is Astra's position? "Astra is a private venture so it is very dependent on having domestic antennae looking at the satellite," he explained.

"If there isn't going to be one common standard, then we will have to make a decision which forces us into the front line in terms of stimulating the manufacturing industry to produce consumer hardware."

Pan-European Programming

With ten different language markets in Europe, most of Astra's potential customers are interested in MAC's potential to transmit simultaneous multiple audio signals alongside the TV signal.

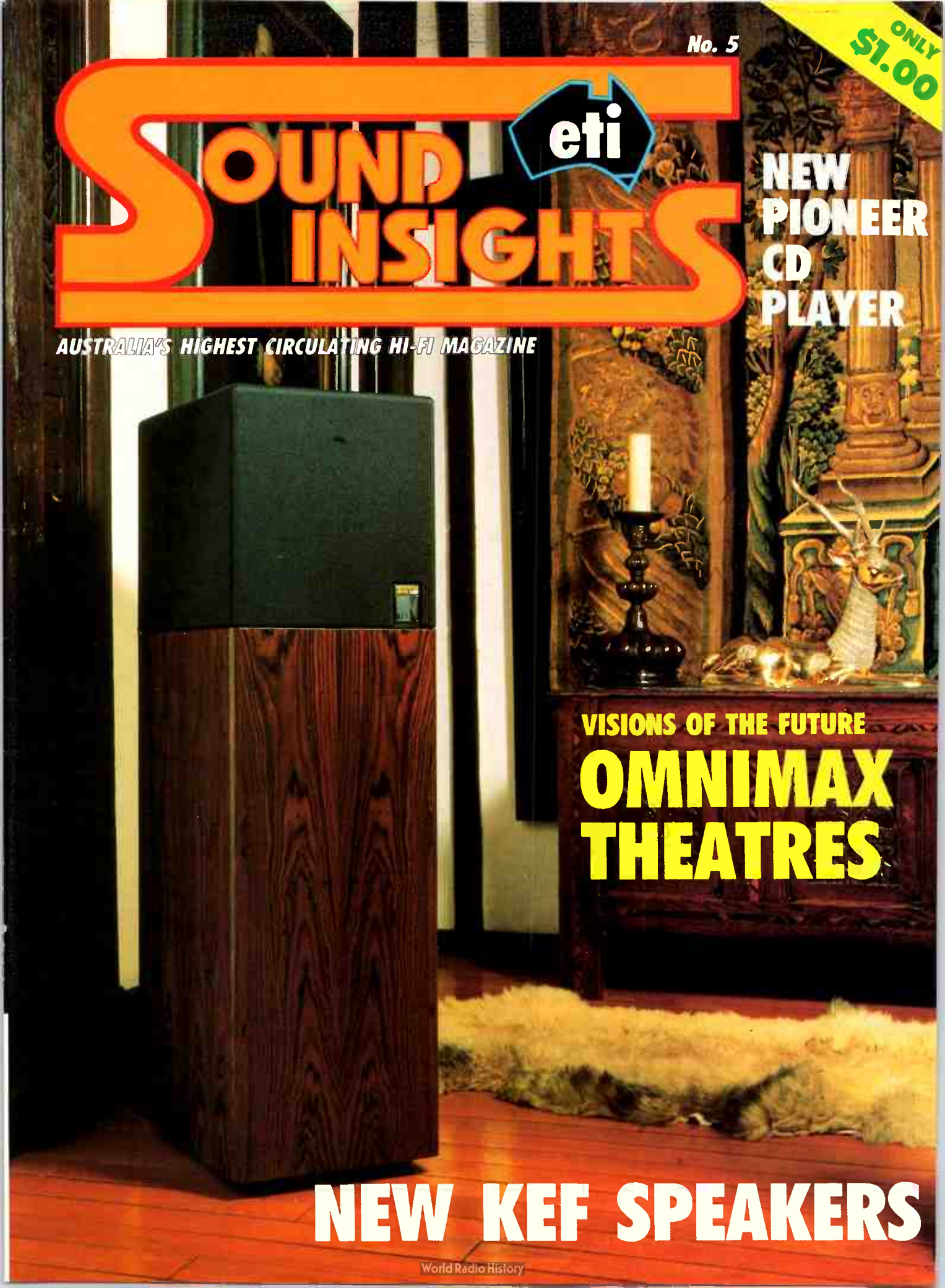
"Programmers can't compete in Germany if they don't transmit in German," Tydeman observed "English-language services such as Sky Channel and Super Channel have discovered this already and have started to put up sub-titles."

He is convinced that programmers seeking to cover the UK, Germany, France, and Scandinavia will move beyond subtitles to multiple audio in the future. "For example, they will carry "Neighbours" or Flying Doctor" in English, German and French plus a local language."

Astra's first customer is likely to be Compagnie Luxembourgeoise de Telediffusion (CLT), which operates two different services out of Luxembourg using mainly French and German language programmes. CLT has also just taken a majority 25 per cent share in M6, the new broadcast channel in France.

The growth of multi-channel, multi-lingual satellite entertainment has already triggered changes in the structure of the European production industry. "Nationalistic channels are running around trying to set up joint ventures with French or German or Dutch production houses," Tydeman commented.

The European Economic Community (EEC) has also produced guidelines on European content requirements for satellite services to ensure the satellite "feast" does not turn into a "famine" for producers who fear the importation of cheap North American programming. ●



New releases from KEF and Pioneer and the creation of OZFI form part of this month's Sight and Sound.

Sight and Sound News

KEF: Something Old, Something New

Cover Shot

Our front cover photograph pictures a 'classic' KEF 107 speaker, classic in design more than appearance.

Back in the 70s KEF research into loudspeaker performance set standards in the objective analysis of acoustic effects, particularly on resonance effects from cabinet, diaphram and baskets. The results were successfully materialised to reviewer and public acclaim in various models. In 1984, for example the KEF 104/2 model was released incorporating what KEF described as a "twin coupled-cavity bass loading method" to provide maximum handling capacity around the 70 to 100 Hz region. The later 105 model included a special head assembly to reduce mid-range colouration.

Both these features have been included in the new 107 model with the head re-engineered for slightly larger internal volume and improved structural rigidity. The head assembly also uses a mineral-loaded polymer, used originally in the Series KM1 Monitor, and connectors between bass cabinet and head are gold-plated XLR.

More recently, KEF research has involved using computer analysis of the low frequency content of recorded material. As a result the 107 has a 72-litre low frequency enclosure which, KEF claims, provides response below 18 Hz. The speaker measures 1165 x 330 x 448 mm and weighs 45 kg.

Other improvements in the 107s are, according to KEF, a new voice coil and polypropelene cone with the aim of raising inherent sensitivity and power handling levels. The head assembly with its upward-vented low frequency energy rotates for convenient positioning. Other features are a conjugate load matching crossover network and a hybrid network design.

KEF specifications for the 107s are 20 Hz to 20 kHz ±2 dB frequency response at 2m on reference axis; 4 ohms nominal impedance, and 112 dB SPL on program peaks maximum output. If you're interested in the 107s look out for their review in Sound Insights next month.

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The Sanyo Package

Among the Sanyo range of packaged audio systems recently released is its Midi System-W400 CD which, as its name suggests, includes a CD player. The player is programmed to select up to 16 tracks and has the usual skip, pause and repeat controls.

For $1099 you also set a full automatic belt drive turntable, a 20 watt RMS per channel amplifier, and FM stereo/AM synthesiser tuner, double cassette deck and high performance 2-way, 4-speaker system. The tuner can be programmed to 18 stations and comes with a five-band graphic equaliser.

If you don't want to spend $1099 on a system, the range begins at $400, with fewer features.

R.I. No. 144

Mix and Match

If you've been constrained in your home entertainment designs by a single auxiliary input on your amp, Arista Electroncs is selling a very neat product which plugs in a CD player and video unit to an amplifier.

The CDA-3 switches between CD and video as you require with signal matching of 150 mV, 300 mV, 600 mV, 1 V and 2 V unit outputs to a 750 mV input amp.

R.I. No. 145

New Citation Range

The new Harman/Kardon Citation Series preamplifier, power amplifier and active tracking tuner go on sale this month.

The Citation 21 Control Preamplifier features symmetrical circuitry throughout, ultra-wide open loop bandwidth with low negative feedback and phase correct loudness circuitry. A CD direct function channels the digital CD signal directly to the preamplifier outputs if required. As well as this the preamplifier has tone defeat, facilities for two tape decks, subsonic filter, mono switch and gold-plated input and output connectors.

The Citation 22 dual voltage power amp is FTC rated at 200 watts per channel into 8 ohms stereo, 200 watts per channel into 4 ohms stereo, and 400 watts bridged mono into 8 ohms.

Last but not least, the Citation 23 Active Tracking Tuner's claim to fame is a system that tracks the actual FM carrier modulation of a particular broadcast, thereby rejecting interference from adjacent channels. Other features include a full-function infra-red remote control. digitally synthesised quartz-locked tuning, flywheel stablised tuning knob, seek and manual tuning and 16 random presets.

R.I. No. 151

Tuner/preamp Unit

A new release from US company Adcom is the GTP-500 tuner/preamplifier. Combining these two components on the one chassis, Adcom claims, has been achieved by keeping low current, low voltage elements away from the high voltage, high current ones. The result, it says, is 60 W per channel converted to 600 W per channel.

The tuner/preamp comes with a remote control over power, selection of (16) preprogrammed stations, FM scan, volume and source selection.

R.I. No. 146

DAT Travels in Japan, Stalls in Australia

Pioneer has recently been parading its latest product, the D1000 digital audio tape (DAT) player.

Unfortunately, Pioneer like other DAT manufacturers has been forced to demonstrate the lion without the roar, that is, minus its digital recording feature, and has conducted its shows with an analogue recording from a CD player. Why so? Because of the familiar fear of copyright infringement.

The story is an old one now. Under pressure from promoters of compact discs, recording companies and artists, the US is seeking to ban the import of DATs unless they come with some technique for preventing the (perfect) recording of CDs or a tariff is imposed on blank tape (video and audio). The situation is complicated by the inclusion of DAT players as a casualty in the US-Japan trade wars.

DAT manufacturers are delaying their release generally until this mess is cleared up and the D1000 won't be released here in the foreseeable future. In Europe the situation is somewhat different. Following the West Berlin Consumer Electronics Show, Sony moved to release a DAT player in West Germany (where a tax is paid on all blank tapes) in October.

However, DAT player manufacturers like Pioneer are complying with the anti-CD record requirement. The Pioneer D1000 can record digitally at 48 kHz (for example, from other DAT players) and at 32 kHz (useful in future satellite broadcasting recording) but not at the 44.1 kHz CD player sampling frequency.

So what about prerecorded DATs? At present there are no digitally prerecorded tapes to feed DAT player — or record from. You can make live digital recordings if that's your go, but that's obviously a limited consumer application. In practice, the best sound you can get from the D1000 is the reproduction of an analogue recorded CD. So disc goes with DAT so to speak.

That hasn't stopped developments though. Last August in Japan, and ahead of its competitors, Kenwood released a car DAT player. The KDT-99 measures 125 x 150 x 46 mm and uses a DX-7 DAT mechanism, that is, the 4DD system of direct drive of drum/capstan/reel motors along with a circuit board which controls servo and signal process/error corrections. A tuner function for connection with an optional concealed tuner is also built in.

With regard to portability, DAT has an obvious advantage and while KEF has released a car DAT player, Sony has released the world's first portable DAT player, the TDC-10 which weighs 1.85 kg. It will go on sale in Japan in December.

Nevertheless, the D1000 has plenty of appeal. Part of the Pioneer Reference Series, the player offers all the expected features of modern cassette players including programmability, skip and search, and it goes a bit further in allowing you to skip not only tracks but an interval on the tape as long as you require. Rewind time from beginning to end (or rather end to beginning) of a 60 minute tape is only 26 seconds.

Other features of the D1000 are twin mono construction throughout, cassette stabiliser, copper coated chassis to avoid electromagnetic induction into sealed wires, a digital filter in both recording and reproducing circuitry to reduce distortion from another signal source. But DAT technology is irrestible and we'll be reviewing the Pioneer D1000 in December ETI even though Pioneer won't be releasing it in Australia in the forseeable future. If you want one, get it en route to Japan. And the price? If it were retailing here it would be at around $5000.

R.I. No. 152

Pioneer Hi-fi CD and Radio/cassette

R.I. No. 147

While Pioneer is proudly publicising its new D1000 DAT player, it has been no slouch on releasing the more traditional hi-fi components and keeping its fingers in both pies with DAT's arch rival the compact disc player.

On the mini shelf hi-fi system front are three new releases, the X220, X550R and X880R. Basic to each system are double cassette deck, AM/FM tuner, turntable and 5-band graphic equaliser. Cheapest at around $999 is the X220 with 16 cm flat woofer, 2-way speakers. The more enhanced X550R features auto reverse cassette deck, 24 preset selection and music search on the tuner and at around $1399 comes with 23 cm, 3-way speaker system with magnetic shielding. Top of the range at $1999 is the X880R which adds Dolby B/C, PLL synthesised AM/FM tuner, 19 cm 3-way speakers and a surround sound rear speaker to the list of features. The X550R and X880R come with a cordless remote control unit.

An optional CD component for the shelf system is the PDX88 or the multi-play PDX9M. Pioneer's other CD player releases are the PD4050, PD6050, with 16 and 24 track random program play respectively, and the PDM40 and PDM60 with a 6-disc magazine and either 32 or endless track random play program. Prices range from $439 to $999. (See review of the PDM40 this issue).

As well as these items, Pioneer has released two car radio/cassette players. The KEH 5252 and 9292 incorporate Pioneer's Flex Fader to control output balance between built-in an add-on amps. Features include anti-tape slack canceller, 18 station preset, pulse noise suppressor and locking fast forward. The 9292 has Dolby B/C, music search and key off pinch roller.

R.I. No. 148

ProAc Loudspeaker

ProAc has released the curiously numbered Studio 1 loudspeaker, successor to the Studio 2 and Studio 3 speakers.

The new Studio 1 measures 200x400x237 mm, is made of medite and veneered inside and out. Inside the cabinets are 1-inch, ferrofluid cooled and damped tweeters which, according to a recent report, are thinner than human hair. The woofers are doped on the inside and, for those familiar with the Studio 2 version, the 1s for-go an octave in bass extension which is reportedly compensated by better inegration of woofer and tweeter with crossover point at 4500 Hz.

ProAc is a British company guided by a man named Stewart Tyler, who first established a company called Celef and has experimented with various speaker designs for ProAc, including the rather successful Tablette speaker. If you want to sample the Studio 1s in exotic locations, head off to the London Royal Opera House, otherwise check the reader information listing.

R.I. No. 149

Sharp Radio/cassettes

Sharp has released three new stereo radio cassette recorders which use its 'Twincam' mechanism. This mechanism is used to rectify speed deviations and revolution irregularities by stacking tapes one behind the other with single motor driver operation.

The Budget Twincam, the WQ-T232 is rated at 50 watt pmpo power, has a 2-way, four speaker system, 3-band graphic equaliser, CD line-in, and bass reflex ducts. The Spectrum Twincam model, WQ-T252, is the same with 60 watt power rating, 5-band spectrum analyser and auto-program-search system. The third model is the Auto Reverse Twincam, WQ-T483. This one is portable, features auto-reverse, auto-reverse dubbing, and 70 watts power rating.

R.I. No. 150

Aussie Push on Hi-fi

Australian hi-fi manufacturers have banded together in an effort to set their products better recognised and appreciated both here and overseas.

Perhaps the most famous and experienced of Australian manufacturers is Cyril Murray whose professional quality amplifiers were used at the Commonwealth Games in Brisbane in 1984 and are now installed in the New Parliament House. But there are many more Australian hi-fi manufacturers quietly producing quality exportable products in a range of sizes, prices and complexity. At $13,000 (and two metres tall) a pair are the Duntech Sovereign 2001 speakers made by John Dunlavy in Adelaide. Slow sellers in Australia, these speakers have been acclaimed by reviewers in the Germany, Hong Kong and the US where apparently they can't get enough of them.

More affordable at $499 per pair are the Richter speakers made by Ralph Waters in Sydney, which Louis Challis recently praised as equal to the best he'd encountered in that price range (see ETI Sound Insights July 1987). Ralph Waters is one of the activists behind the newly formed Australian Hi-Fi Manufacturer's Guild or, affectionately, OzFi. According to him, Aussie manufacturers of hi-fi have wanted an association like this for some time, giving them collective clout to lobby the various Australian governments to use Aussie hi-fi goods and to help promote goods under the Australian OzFi label at trade fairs and the like here and overseas.

Strange as it may seem, some Australian hi-fi manufacturers have found more support from the critics and the buyers overseas than in Australia. That has certainly been the experience of Alan Wright of Vacuum State amps. Wright recently toted his valve preamplifiers around Europe with considerable success, obtaining dealerships in Europe, and in Britain (with the same crowd that distributes Rock turntables which were recently cited in *Absolute Sound* as the best in the world). It is something of a tribute that hi-fi guru Van den Hul now uses an Alan Wright preamp. Yet in Australia, Wright struggles to keep the distributorships that he has. Apparently the Australian public is not interested in the Australian product no matter how good it is.

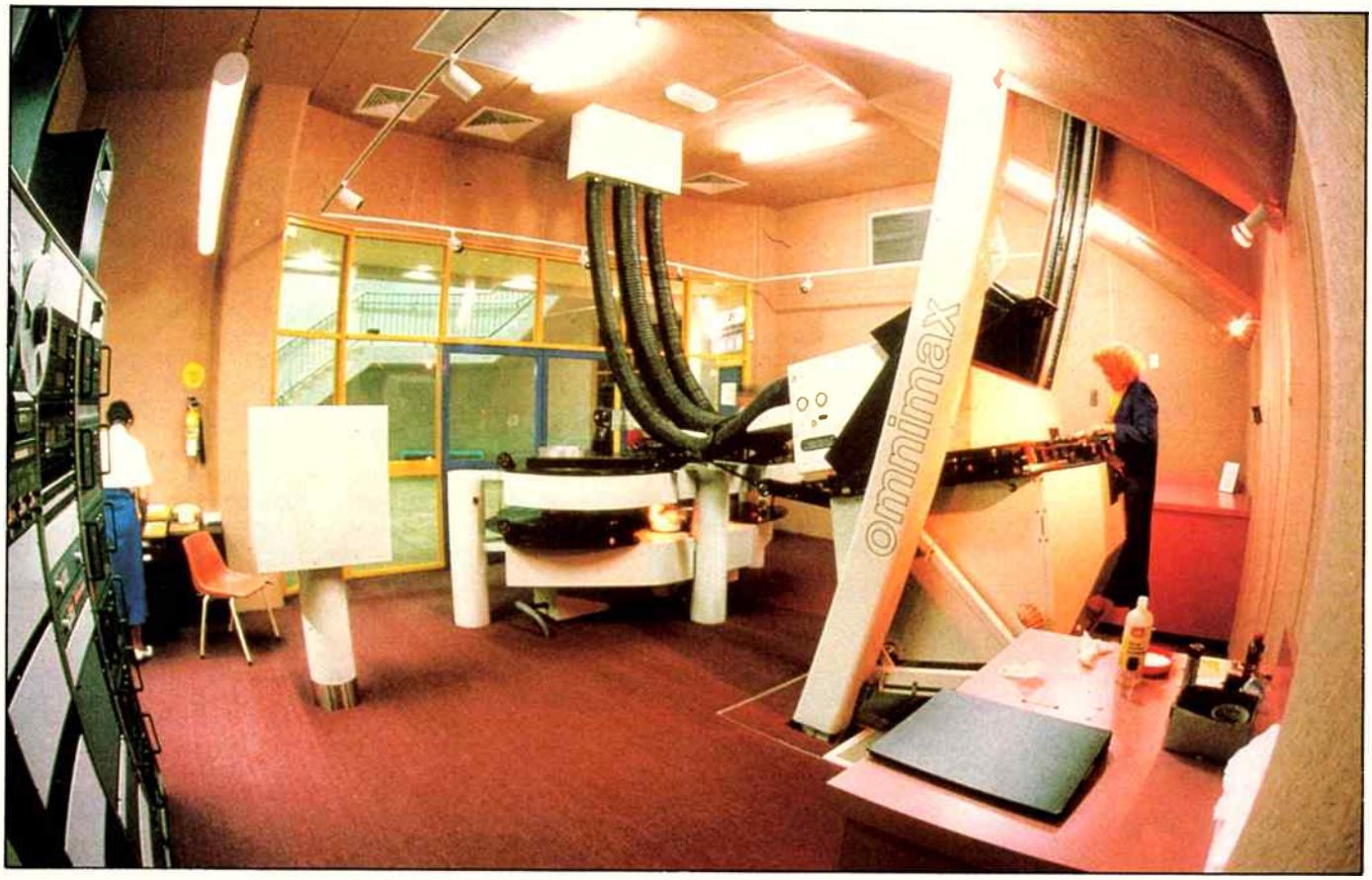
This reluctance, or ignorance, about Australian products available is something the guild can tackle by disseminating information, press releases and the like and by its mere existence, as a body that interested parties can consult.

The group, which initially consists of Waters, Cyril Murray, Matthew Bond (That's tapes), Peter Stein (ME Amps), Brad Serhan (Orpheus speakers), Ron Cooper (Audio Sound Labs) and Alan Wright is based in NSW but plans are to make it an Australia-wide association. Criteria for membership is that one must be a designer/manufacturer, that he/she be dedicated to genuine hi-fi products and that the person have a demonstrated interest in live musical performances. Says Waters: "It is ridiculous that anyone engaged in the manufacture of products designed to reproduce music is not intimately acquainted with what live, real music sounds like." Waters is also keen to stress a certain element of craftsmanship in the product of the small scale Australian and point to the term "guild" to underline this. One of the selling points of the Australian product is the opportunity to obtain custom-designed items.

For more information on a product circle the reader information number as quoted at the end of the news item on the reader information card and forward the card to ETI Reader Information Service, PO Box 227, Waterloo, NSW 2017.

Townsville leads the nation into a cinematic revolution

High-Tech Movies



The operations centre and projection room of the Omnimax theatre is open to the public gaze. The operator laces up the projection head before raising it into the theatre environment. Sound dubbers can be seen at the left.

AUSTRALIA'S FIRST OMNIMAX movie theatre opened last June in Townsville and not, as promised, in Sydney.

IMAX, rectangular parent of the hemisperical Omnimax, first came to light at Osaka's Expo 70. A Brisbane engineer had conceived the crucial projection movement, a Norwegian built the first camera, German optical brains the lenses — and Canadian enthusiasm fitted it all together. And neither a dime nor a dollar from Hollywood!

However whereas IMAX had filled a curved, rectangular screen, Omnimax is designed to use a hemispherical projection surface, employing fish eye camera and projector optics.

The Omnimax camera uses 'standard' 70 mm film, running horizontally through the camera at 102.6 metres per minutes; each frame is 49 x 70 mm in size. In comparison 35 mm movie film lumbers along at a stately 27.4 metres a minute, with a minuscule 15 x 21 mm frame, less than a 10th the area.

Answers From Queensland

Critics had claimed it impossible: 'How could the world's largest film frame be projected without tearing itself into shreds?'

The answer was to be found in the Brisbane inventor's Rolling Loop Projection Movement. Avoiding the violently mechanical pull-down claw that has been around since Mr Edison's time, Ron Jones devised a method of film motion past the projector's light source that owed much to dynamic geometry, and nothing to Victorian mechanics.

Australia's $1.5m dollar Omnimax installation has been installed beside Townsville's Ross Creek. Inside the domed cinema two movies are showing in the magna screen process: the Space Shuttle epic, *The Dream is Alive* and the regionally appropriate *Great Barrier Reef*.

Fear Induction

"Dream" is a stunner, with amazing inboard shots made by, and of, shuttle flight crews on three missions. In Omnimax you find yourself thrust into the space vehicles' cramped quarters. Six track sound, with additional ultra low frequency enhancement, fills in the sensory voids.

The later technique is a result of US Government experimentation during WWII which found that low frequency emissions

The building houses not only the $1.5m Omnimax theatre, but aquarium, museum and tourist attractions.

Barrie Smith

over a 20 minute period produced feelings of unconscious anxiety, and at one stage was considered as a potential military weapon. Hitler was well aware of the effect, and had low frequency sounds played before his speeches at his rallies.

In the overall plan of the theatre the Omnimax screen forms an integral part of the projection system; forming a 160° to 165° segment of a hemisphere, it and the audience are tilted at an angle of 25 degrees, with the projection lens located a short distance beyond the hemisphere's centre.

Stats

Seating 200, the Townsville theatre's domed screen is 18.75 metres across. Covered with a grey-pigmented vinyl plastic skin, it provides a fully-diffusing matte reflecting surface which results in a uniformly lit image.

The screen gain (ratio of reflected light to incident light) is in the range of 30-40 per cent reflectivity, giving low cross-reflectance, with enhance colour saturation and contrast. The low reflectance screen, and immense area call for a high intensity light source. A horizontal lamphouse holds a 15,000 watt Xenon short arc, backed by an air-cooled elipse-based collector mirror, high voltage starting transformer, starting circuitry, coolant flow controls, air-circulating fan and safety interlocks.

Water-cooled piping feeds distilled water at 150 psi — (1030 kPa) pressure to the lamp electrodes. The lamphouse includes two dielectric coated beam-folding cold mirrors with water-cooled heatskins, and an air operated, water-cooled dowser.

Mr Leitz's Fisheye

Operators are warned not to run the film with the light source at full power for more than five seconds — or damage to the projection lens will ensue. The lens is one of Leitz's costly 25 mm fisheyes, specially made for Omnimax to provide horizontal coverage of 180°, and a vertical 125°.

Ominmax sound comes from an interlocked Magnatech 35 mm magnetic playback unit, running at 27.43 metres/minute. This dubber carries six channels, plus the set of bass enhancement speakers. Altec A4 speakers are used on left, centre and right channels. Total power of the system is 2100 watts.

The screen is finely perforated over 20 per cent of its area to allow the multi speaker array to project its signal without distortion or loss of directional identity.

The projector is split into two separate assemblies, the Rolling Loop Projector and the Dual Film Reel Unit. The projector spends its working life at the top of an elevator, the film passing before its lens being fed from the Reel Unit one floor below the audience. A Projector Elevator is used to raise and lower the projector.

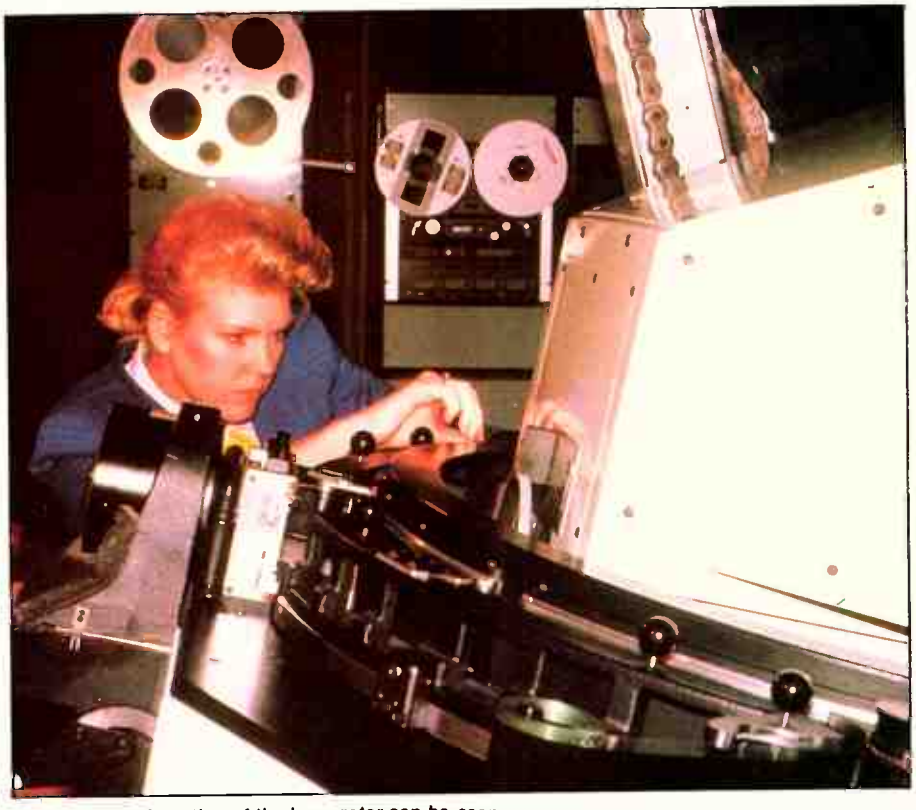
The Projector

The projector itself consists of a horizontal rolling loop mechanism which moves each frame of the film horizontally across the aperture in six milliseconds, at 24 frames per second. The Rolling Loop movement has six precisely synchronised mechanical components which advance the film, frame by frame.

The rotor, a 9525 mm diameter drum, contains eight windows. Each forms a loop or wave in the film as it passes the input sprocket, and then advances the film past the aperture, where a cam and registration pins position each frame at the point of illumination. The system closely resembles the closed capstan system of some audio tape recorders. Steadiness on screen is high — less than 0.04 per cent in any direction; print life is extended — 1000 showings being the norm.

Margaret Talbot, one of the installation's projectionists stresses: 'The system looks complicated, but it's not. The operator sits in the theatre, and can operate the machine, focus, lens cleaning, lights, sound, etc. If a speck of dirt lands on the field flattening quartz lens a button is pushed on the control panel and a wiper cleans it off.'

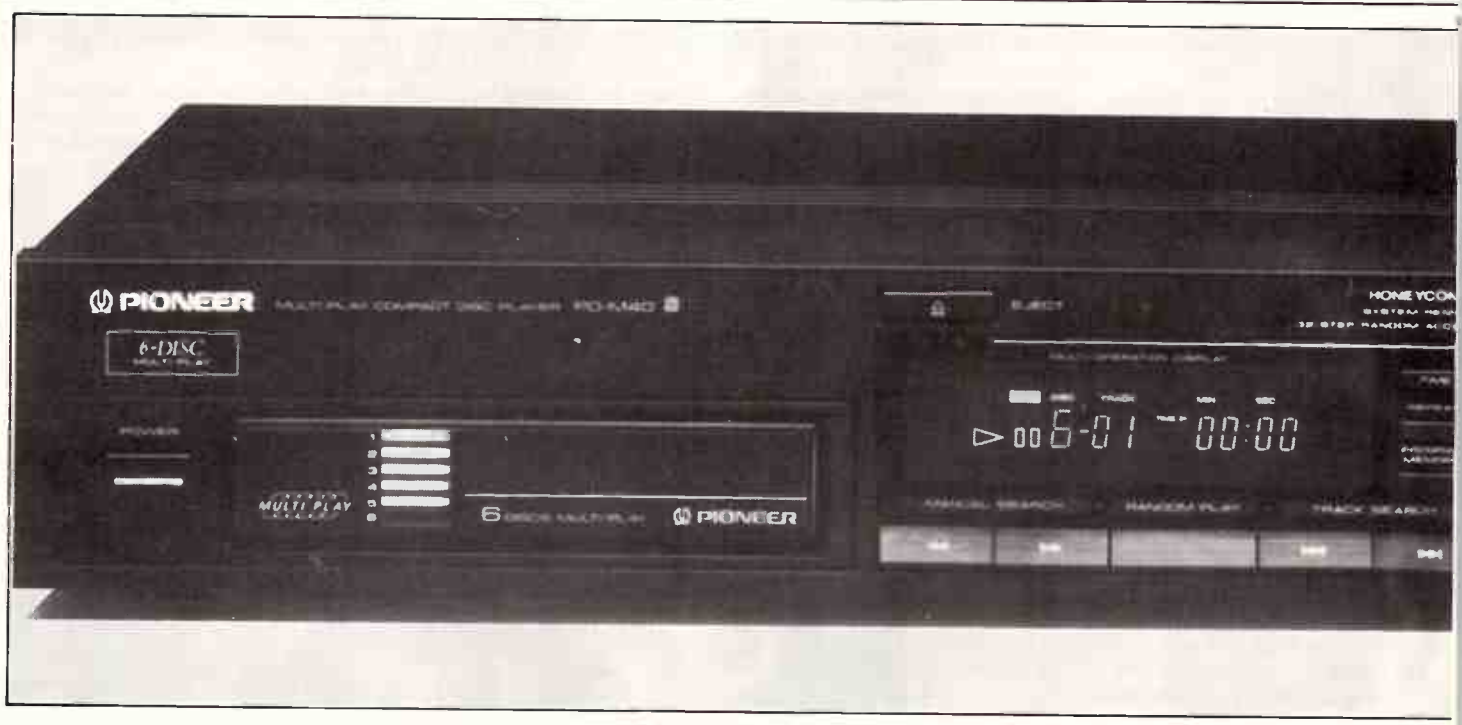
The theatre runs seven days a week, a total of 68 sessions, with a scant 10 minutes between changeovers. The projection room is open to public gaze, and gaze they do as the giant projector descends from the ceilings, ready for a reload after an exhausting 40 minutes plus of rolling loops, high intensity light and eye-stretching optics. ●

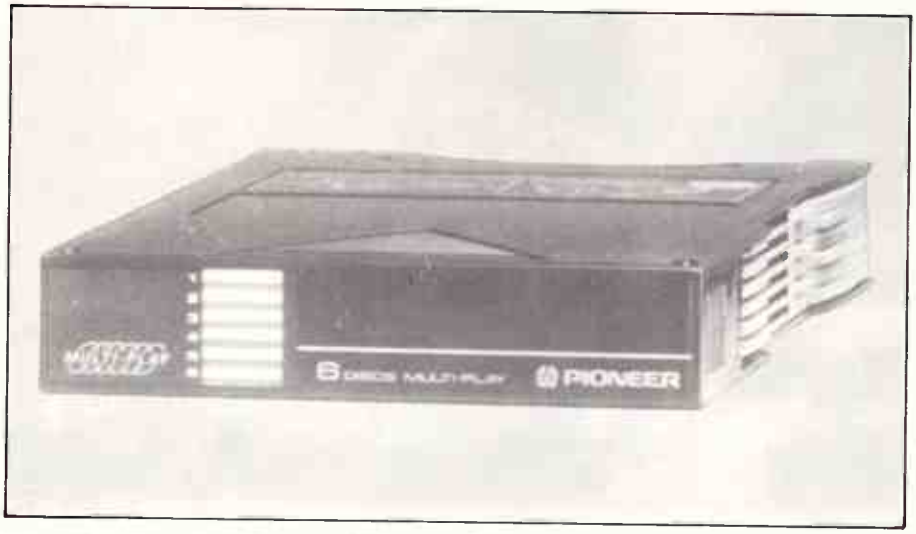


Lace up time. A section of the huge rotor can be seen.

Pioneer's PD-M40 was released in the US in January 1986 to rapturous applause. It recently debued in Australia and the industry has been equally impressed, but would you buy one?

Pioneer PD-M40 Multi Disc Player



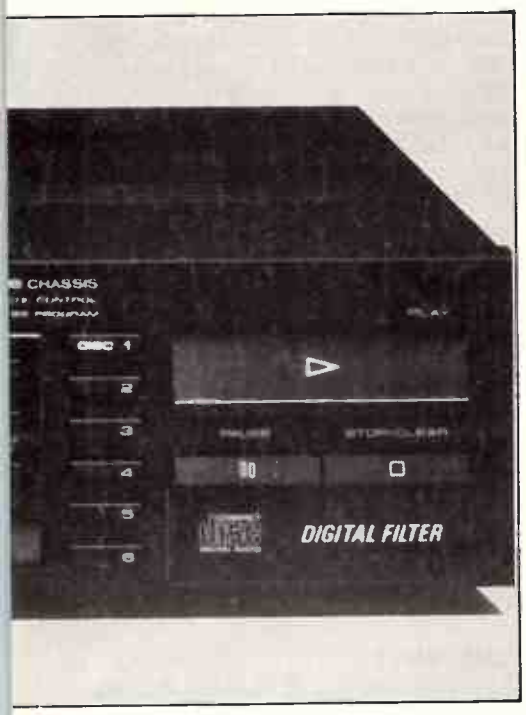


THE PD-M6 and the revised version in the form of the PD-M60 were the first CD players to provide the up market CD features of a stacked record changer. These offered the attributes that many music lovers desire: i.e: the ability to play many hours of music without having to touch their equipment.

The PD-M40 is the latest economy version of the PD-M6, and like its more expensive brother the PD-M60, provides a number of convenient advances like a random play function and a lower price tag.

Dimensions: 420mm wide x 315mm deep x 80mm high.
Weight: 4.9 kilograms.
R.R.P.: $699.00.

Louis Challis



The heart of the PD-M40 is its compact disc magazine with six corner hinged plastic trays, each of which has a carefully designed tab on one edge to allow you to open it out for loading or unloading. Both the handbook and supplementary pink slips provided with the player caution you in five languages "to be sure to remove the disc trays one by one" — otherwise the disc magazine may be damaged. I tried to pull out two at once and found this was extremely difficult. Had I persevered I would have undoubtedly damaged the components.

Once you load the disc tray the task of loading it into the PD-M40 is easy; it just pushes into the slot on the left hand side of the front panel. Apart from the power switch next to the cassette slot, all the primary controls and the display are located on the right hand side of the front panel.

The major controls of PLAY, PAUSE and STOP/CLEAR are located on the extreme right hand end and are large, clearly labelled and very convenient.

Controls

The minor controls including the cassette EJECT button above the central display and the forward and reverse MANUAL SEARCH and forward and reverse TRACK SEARCH are located below the display. Centrally located between these rectangular controls is the RANDOM PLAY control which is a function peculiar to this unit. With six discs loaded in the cassette the player will randomly select each and every track on each of the six discs. It will remember in its internal memory which track has been played so that you don't repeat the exercise and will go on playing until all tracks on all of the discs have been played. The only catch is that if a particular disc has 63 tracks (and that only occurs on special test discs) it will not be able to store all of the required information.

There are three other keys on the right hand side of the main display, one marked TIME which utilises the display to indicate playing time elapsed, the track time remaining or the total recording time on the disc. The push button below the time switch is labelled REPEAT and enables you to repeat all of the tracks on the disc. If the player is operating in programme playback mode, it enables you to repeatedly play all of the programmed tracks in the programmed order. If you have selected random play mode and use this switch, the random play process will repeatedly be activated. This is particularly useful if the player is being used as a background music system in a shop, office or other commercial application. Two separate cassettes, holding a total of 12 discs, can provide up to 12 hours of playing time without repeating.

If you wish to programme a sequence of tracks, the procedure is relatively simple, although less convenient than that provided by CD players with more comprehensive keyboard facilities. the process involves selecting the disc number from one of the six vertical keys located to the right of the display and then selecting the track number by utilising the track search key which is then repeatedly pressed to display the track number on the main display.

Although I personally found this a trifle tiresome with six discs in the cartridge (and with up to 70 tracks on the discs), it does provide a capability for those who need it. Most people will play the six discs straight through from end to end by pressing the PLAY or random button and letting the player do the rest.

The Internals

The back of the unit features a pair of RCA co-axial sockets, and a pair of control IN OUT sockets which enable the CD player to be controlled by a Pioneer (SR) Mark amplifier remote control circuit. As I did not have a matching amplifier I was unable to evaluate this feature. The player features an unusual honeycomb embossed amplifier panel for enhanced rigidity. It has one large printed circuit board on which nearly all of the main electronic components are mounted. Surprisingly, there are not all that many components as the complement of active devices is limited to 17 integrated circuits of various sizes mounted on a board which is designed to cater for other variants of the PD-M40 or 60 family.

The heart of the system is the multiplay unit which is beautfully made from steel and plastic and, subject to no abuse, should provide years of trouble free operation. The unit is designed for ease of assembly as well as for ease of mainten-

MODEL No. PD-M40
SERIAL No. HE8603140T

1. **FREQUENCY RESPONSE:** 20 Hz to 20 kHz +0 −0.6dB
2. **LINEARITY:** @ 1kHz

NOMINAL LEVEL	L. OUTPUT	R. OUTPUT
0dB	0.0	0.0
−1.0	−1.0	−1.0
−3.0	−3.0	−3.0
−6.0	−6.0	−6.0
−10.0	−10.0	−10.0
−20.0	−20.0	−20.0
−30.0	−30.0	−30.0
−40.0	−40.0	−40.0
−50.0	−50.0	−50.0
−60.0	−60.0	−59.9
−70.0	−69.8	−70.3
−80.0	−79.2	−81.3
−90.0	−88.1	−92.2

3. **CHANNEL SEPARATION:**

FREQUENCY	R. INTO L. dB	L. INTO R. dB
100Hz	−78.8	77.7
1kHz	−81.9	−80.3
10kHz	−78.9	−77.4
20kHz	−74.0	−73.1

4. **DISTORTION:** @ 1kHz

Level	2nd	3rd	4th	5th	THD%
0	91.3	96.0	106.5	1.3	0.0033
−1.0	91.0	—	105.5	—	0.0029
−3.0	93.9	—	104.6	100.8	0.0023
−6.0	90.6	96.0	—	98.1	0.0036
−10	90.6	—	94.3	100.4	0.0036
−20	84.6	—	—	84.0	0.0086
−30	—	—	—	75.5	0.017
−40	—	—	—	66.5	0.047
−50	61.6	57.5	—	61.2	0.18
−60	—	44.5	—	—	0.60
−70	39.8	38.2	—	38.8	2.0
−80	29.6	16.8	32.2	28.9	15.45
−90	12.1	22.3	13.9	10.6	44.2

4. **DISTORTION:** @ 100Hz

Level	2nd	3rd	4th	5th	THD%
0	96.9	96.9	103.4	112.7	0.0021
−20	92.2	93.8	96.4	81.2	0.0094
−40	75.0	99.2	—	78.0	0.222
−60	50.2	49.6	47.5	54.5	0.065
@ 6.3kHz					
0	93.4	89.4	—	—	0.004

5. **EMPHASIS**

Frequency	Recorded Level	Output Level (L)	Output Level (R)
1kHz	−0.37dB	−0.5	−0.5
5kHz	−4.53dB	−5.3	−5.2
16kHz	−9.04dB	−8.6	−8.6

6. **SIGNAL TO NOISE RATIO:**

Without Emphasis	69.0 (Lin)	92.7dB(A)
With Emphasis	72.6 (Lin)	97.3dB(A)

7. **FREQUENCY ACCURACY:** (19.999kHz) — Hz for 20kHz test signal
8. **SQUARE WAVE RESPONSE** (See attached photos)

Interruption Information Layer	Black Dot at Read out Side
400 micrometer; Passed	300 micrometer; Passed
500 micrometer; Passed	500 micrometer; Passed
600 micrometer; Passed	600 micrometer; Passed
700 micrometer; Passed	800 micrometer; Passed

800 micrometer; Passed
900 micrometer; Passed
BLACK STRIPE TEST (Passed)

ance, but hopefully that won't be required.

The testing of the unit provided an excellent insight into the electronic design and its performance compared with previous generations of Pioneer CD players.

The frequency response is remarkably flat all the way from 5 Hz to 2 kHz after which it gently droops down by 0.6 dB at 20 kHz.

The linearity is excellent. It's almost perfect all the way to −60 dB, below which there are miniscule traces of non-linearity evident between −70 and −90 dB. The left channel and right channels differ slightly from one another straddling the absolute values between them.

Channel separation is excellent being better than −73 dB at all frequencies and more than adequate for this task. Distortion with a 1 kHz test frequency is also excellent all the way down to −60 dB with an obvious plateau being evident between 0 dB and −10 dB. Between −10 dB and −60 dB the distortion rises slowly because of the smaller number of available 'bits'. At −70 dB the distortion has crept up to 2% which is a trifle higher than I would like, but very hard to hear when listening to material which is so low down in the dynamic range. The distortion figures at −80 and −90 dB are moderately high at 15% and 44% respectively, but as I have noted with most pre-recorded material there is little real content at these low levels and consequently these values are still quite acceptable.

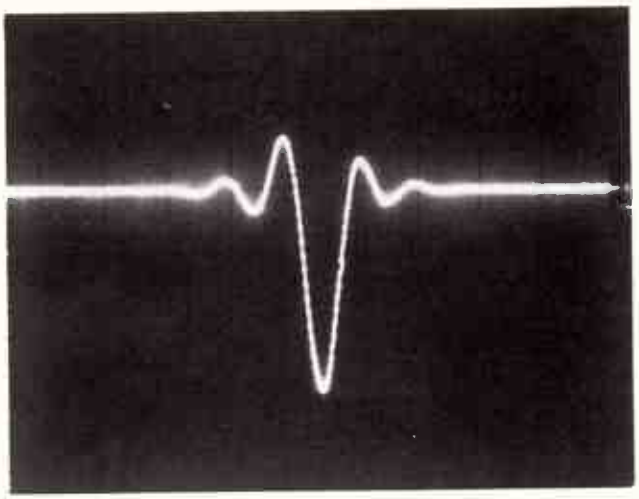
Test Discs

The player is capable of tracking all of the interruption and black dot tests on our test discs and exhibits no unusual vices with normal test disc material. With our nastiest test discs incorporating eccentric centres, the PD-M40 rejected the disc and quickly moved to the next one.

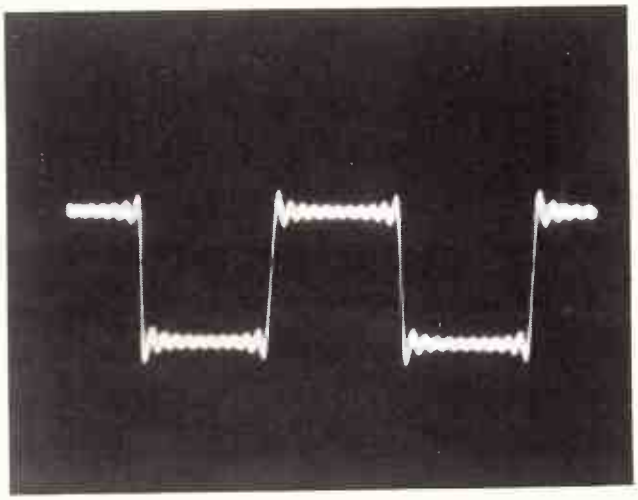
The test signals with impulse responses display a noticeable lack of symmetry. The phenomena is associated with the type of digital filtering utilised by the circuitry. By contrast the square wave response shows the classical symmetrical characteristics of a digital filter.

I was fortunate to have a number of new CD discs available for my assessment and loaded each of the new discs into the single cartridge provided with the player in order to evaluate the quality of reproduction and the functional characteristics when playing background music.

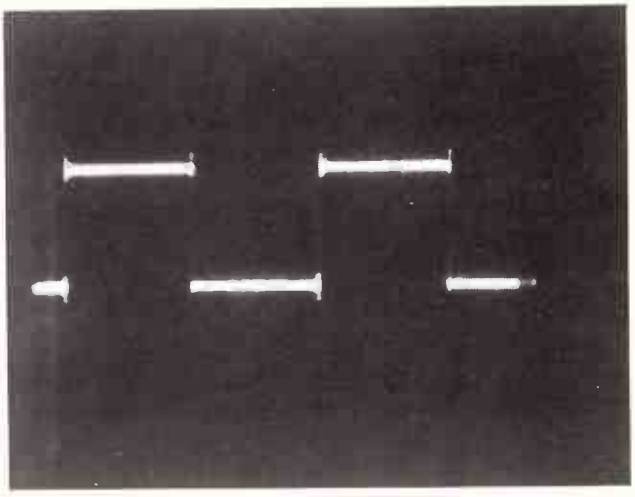
The discs that I employed include the following new discs each of which was carefully chosen for its quality and clarity. They were firstly two conventionally



Impulse Response



1 kHz Square Wave



100 Hz Square wave

priced discs:

Bartok's *The Wooden Prince* and *The Miraculous Mandarin;* Beethovens' Piano Concerto No. 5 in E. Flat Op. 73 *Emperor*, Digital Recording 416215-2 and three new excellent economy discs from Virgin Records:

Mozart's Clarinet Concerto Flute & Harp Concerto, new Digital Recording PCD 852; Strauss' An Evening of Strauss, New Digital Recording PCD 856; French Impressionist, Piano, Cristina Ortiz, Digital Recording PCD846.

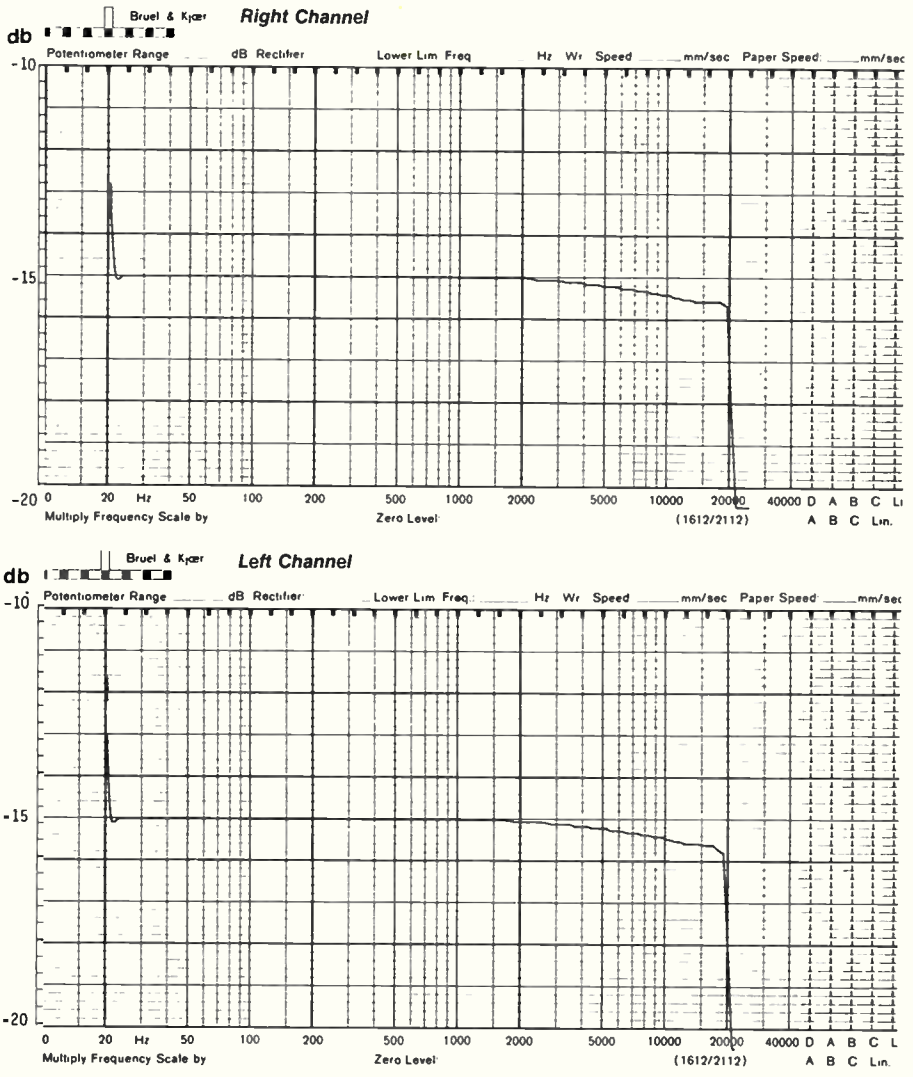
Conclusions

I stacked these into the cassette and selected random play. Some five hours later, apart from the short delays for the disc changing process, I realised that the delightful music I had been listening to had all been (arbitrarily) selected by the microprocessor without human control.

The PD-M40 is a well designed unit carefully configured to cater for a somewhat unusual market. Of the potential purchasers for the PD-M40 I am sure that at least 80% will just play the six discs through in the loaded sequence which the software manufacturers have selected. Of the remaining users, 75% (15% of the original group) are likely to use the random play mode.

It is my bet that less than 5% will seriously tackle pre-programming of the available discs on a regular basis.

The PD-M40 is really designed to cater for commercial users or lazy people who just like to listen to their music without much effort. These attributes are most certainly achieved.



Bose gives you music in your choice of size, shape and colour.

Sound is becoming increasingly important in establishing mood and ambience for residential and commercial environments. Through ongoing research, Bose explores the field of psycho-acoustics to learn more about how sound affects emotions. The result of this research is an innovative line of audio products that allow you to use sound in ways you never thought possible.

When you need to select a speaker system, Bose gives you a lot of options such as advanced speaker systems that are ideal for the latest audio/video entertainment centres. Ceiling speaker systems that can be heard but not seen. Environmental speakers that withstand the elements – from a subzero ski slope to a 200°F sauna. Even colour-coordinating speakers that can be used as design elements.

Our reputation for quality has made Bose the speaker of choice for the Queen Elizabeth II, the Hollywood Palace, the Royal Albert Hall in London and Adelaide's Festival Theatre. The list goes on.

Bose products have earned an international reputation for quality and reliability over the past 22 years. And all Bose products have one common goal: making the environment more pleasing to the ear as well as the eye.

So next time you're looking for speakers look for Bose. Regardless of the size, shape and colour you choose, we know you will be impressed.

For more information, brochures and prices please contact:
Bose (Aust.) Inc. 11 Muriel Ave, Rydalmere, 2116. (02) 684 1022.

N.S.W. & VIC Bose (02) 684 1022. QLD. Stereo Supplies (07) 221 3623
TAS. Chessman Distrib. (003) 393353. S.A. Blackwood Sound (08) 278 1281.
W.A. Prosound (09) 325 1066. N.Z. Rangitoto (649) 274 7860.

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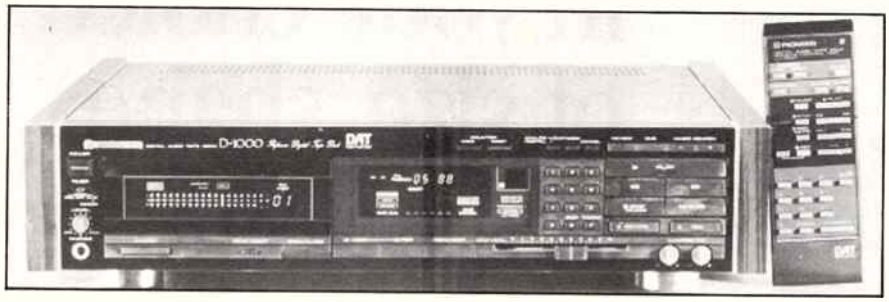
Digital audio tape was the centre of interest at the Perth Electronics Show.

DAT in Perth



Pioneer have entered the DAT race with the D-1000 featured above

WHEN SONY AND the other major Japanese electronics groups put their digital audio tape systems on display at the Berlin Consumer Electronics Fair, it was the first time DATs had been seen in Europe.

But that show was in late August, Australia in general, and the Annual Perth Electronics Show in particular, can claim to be ahead of the Europeans.

For both Sydney and JVC — two of the main contenders in the looming battle over DATs — displayed systems at the electronics show held in the week stradling August and July, roughly about a month before the European debut.

Perth Show

The electronics show is a large event. This year it attracted more than 90,000 people to 10 pavilions crammed with everything from sound systems to circuit boards. But despite the show's size and the controversy surrounding DATs, the new systems rated only the briefest of mentions in the Perth media.

To some extent this apathy is understandable. In Europe, Sony has thrown the audio industry into disarray by announcing it will launch a DAT system there in October, with the other major electronics groups likely to follow the group's lead. Another DAT manufacturer, Marantz, had earlier announced it would be selling the digital systems in the US market about the same time.

In contrast, the Australian representatives for both Sony and JVC state that the groups have no immediate plans to release DATs here, although JVC says that it might do so once the legal problem of recording from other formats was cleared up.

Interested Parties

The commercial launch of DAT systems in Australia, as opposed to mere demonstrations will probably depend on major commercial battles yet to be fought in both Europe and the US.

Another factor ensuring that the events of the Perth show were largely overlooked, was that most of the opposition to DATs has come from the major music companies like CBS and Thorn-EMI, who are based in either the US or Europe.

The only other interested party likely to be affected by DATs is Australia's only manufacturer of compact discs, Disctronics. The management of Disctronics, which has a factory in Melbourne, has said that the DATs will be required to use a different format, so preventing its use as a direct recording device. They also believe the new digital system will eventually bear roughly the same relationship to the compact disc, as the audio cassette now does to the traditional flat record.

With the battle yet to be joined in earnest, and much lobbying yet to be done, there are many who would not agree with that. But whatever the outcome, no-one could accuse JVC of hiding the products, including the DAT system, displayed at the show.

JVC Marketing

The marketing razabatazz included the Playmate of the year, Miss Felicity Collins and a supporting female dance troupe. On the more mundane matter of the product itself, the XD-1100 (a prototype) shown by JVC uses much of the same technology already developed by the electronic giant for its video recording system and compact disc players.

In fact, the digital system bears a strong resemblance to that of the video system, with the digital signal being recorded on the tape by a rotary head with a diameter of 30 mm, which lays the signal down in a series of helical scans across the tape.

JVC's XD-100 is 435 mm wide, 100 mm high, and 310 mm deep, packaged in the usual attractive JVC format with full logic control. Its frequency response is 20 Hz to 22 kHz, it has an "unmeasurable" wow and flutter, and a dynamic range of 96 dB.

The dimensions of the DAT cassette, as displayed at the show and to be the standard in all systems, is 73 mm by 54 mm by 10.5 mm. That means it is about half the volume of a standard analog compact cassette.

The tape width is actually the same as an audio tape, but with a width tolerance of 20 mm, or similar to that of a video tape. The usual tolerance for an audio tape is 50 mm.

Dropouts

Dropouts on an audio tape just cause white specks, but with the DAT system dropouts can cause sound breaks. The dropouts can be corrected, but if they are too large as much as one second's worth of sound can be lost.

Because of that factor, the tape surface has to be specially treated.

The JVC tape uses a Barrium Ferrite magnetic emulsion, which a spokesman says is being investigated by other manufacturers in the quest for better tape performances.

For the audio buff, the more important news is that thanks to the high recording density, made possible by the use of metal magnetic particles on the tape, the rotary head and the digital signal recording format, the JVC DAT tape can record and play up to two hours of material (in standard format).

Tape durability and its ability to withstand being moved are critical factors, but JVC believes that based on the company's extensive work with VHS, VCR and tape technology, the DAT tape prototype has all the necessary qualities.

The format allows room for future expansion with half-speed and four-channel modes included in the specifications. A JVC spokesman said the DAT cassette was small enough to make it ideal for car audios and portable systems.

A Quiet Approach

In contrast to the noisy marketing of JVC, Sony's approach to its display of gear including its DTC-1000ES home digital tape

Mark Lawson

deck was much quieter. The DTC-1000ES tape deck is a two channel stereo system, with a frequency response of 2-22 kHz, a harmonic distortion of just 0.005% and, wow and flutter below measurable limis.

The signal-to-noise ratio of the new system is 92 dB, and its dynamic range is more than 90 dB. Like the JVC system, those figures add up to a powerful sound system, although Sony's version was slightly larger (width 470 mm, height 100 mm and 420 mm deep). About 40 mm of the width is taken up by wooden side panels.

Sony's DTC-1000ES incorporates the four-times over-sampling frequency digital filter, and the dual A/D-D/A converter now used in high-end CD players as well as five new chips specially designed for digital signal processing in tape recording.

The deck also uses a "feed forward super strategy" error correction and interpolation system, which is a powerful system for ensuring high reliability and protecting against signal loss.

The deck uses three sampling frequencies (40 kHz, 44.1 kHz and 32 kHz), with the 48 kHz band being selected automatically for audio recording, and 44.1 kHz used for playback only. When a code specifically prohibiting copying is incorporated in the original digital signal, digital-to-digital recording is not possible, regardless of the sampling frequency.

As would be expected for a product using digital recordings, there are a number of functions for high-speed search, and direct music selection. Specifically, four newly-developed microprocessors in the system put sub-codes on the tape that identify the relevant segment, and which can be later changed or altered. The DTC-1000ES also incorporates "start ID" codes for quick access to selections, "skip ID" for skipping unwanted segments and a program number code for designating selections.

All those features are enough to make a true hi-fi buff's mouth water, and if it were not for the major personal investments already made in CD systems, both Sony and JVC could expect to sell their systems like hot-cakes.

However, initial indications are that the systems will be prevented from recording off compact disks, and that the systems could be expensive. Some reports put the price of a system at around $2000.

Before you it's best to get

Never before in the history of high fidelity sound has a range of hi-fi equipment received such rave reviews from the world's experts.

NAD, standing for New Acoustic Dimension, is a European company which set the entire hi-fi world on its ear by providing the previously unheard of. Superlative quality sound at a ridiculously low price.

We're not just talking about superior sound performance to competitors in NAD's price bracket, we're talking about superior performance to competitors at any price.

As you can imagine, this really put the woofers amongst the tweeters.

Just how much it did, you can judge from the following:

"Nothing gives us more enjoyment than that rare event of finding a product to rave over and the cheaper the product the bigger the thrill. So when something (like this NAD) comes along that is both ridiculously cheap and ridiculously good, we tend to get rather ridiculous."

HI FI ANSWERS–(U.K.)

"What makes this receiver congenial to knob-shy listeners is that fact that it hides its sophistication behind a facade of rare simplicity. In welcome contrast to gaudy models speckled with flashing lights that make them seem like refugees from a penny arcade, NAD opts for visual reticence. In terms of audio styling, this is Saville Row. Front panels are dark, matte and muted. Controls are happily kept to an unconfusing minimum but amply serve all normal needs."

NEW YORK TIMES–(U.S.A.)

"All in all, this new NAD compact disc player is an obvious sonic winner. As a further bonus, its front panel controls are a pleasure to use, in contrast to (others, which are) baulky, frustrating and touch sensitive."

I.A.R. HOTLINE–(U.S.A.)

"Clearly the tuner is far above average: indeed there is no other we know of that can match its overall measured performance."

STEREO REVIEW–(U.S.A.)

"The NAD 6220 is a new cassette deck on the market and is yet another example of (NAD) putting all of their effort and most of their budget into producing a machine with excellent sound quality performance rather than offering lots of

buy a hi-fi a few quotes.

extra facilities. It is this very excellence of sound quality at a low price that gains this player the winner's prize in the budget category this year (1986)."

WHAT HI FI–(U.K.)

"If you believe that I'm impressed with NAD equipment you're right. In some 25 years of audio experience I have rarely encountered such fine sounding equipment at such realistic prices."

SUNDAY TELEGRAPH–(AUSTRALIA)

"...the NAD 5120 (turntable) stands out for me as the most interesting to listen to. Quite simply it allows you to hear more of the music than any of the other three, (Sansui, Harman/Kardon or B&O)."

POPULAR HI FI–(U.K.)

"In fact, the NAD units had such a good measured performance that no product (of the five) in this group could manage significantly better, which is astonishing (since all were double or triple the price and very highly regarded). It is directly due to the ability of their London based designer Bjorn-Erik Edvardson. As a comparative guide, I have never tested a Japanese amplifier that could match the NAD in this sort of detail."

NEW HI FI SOUNDS–(U.K.)

"In the case of the NAD 3020, we're dealing with an inexpensive, modest integrated amplifier. Don't let that fool you. It is capable of real-world performance far in excess of what its specifications indicate and cannot be judged by the same standards as other equipment in its price or power class. Quite simply, it's one of the best buys in audio."

STEREO/HI FI EQUIPMENT–(U.S.A.)

Now you've read what the hi-fi critics had to say. (Although you couldn't say they found much to criticise.)

However, if you can hardly believe your eyes at what you've just read, you are cordially invited to visit the specialist NAD dealer near you or phone (02) 597 1111 for further information.

We're confident you won't have any trouble believing your ears.

NAD

"Ridiculously good.
Ridiculously cheap."

ARISTA THE CATALOGUE

A background on "Arista" and the story behind the catalogue that accompanies this issue of ETI. It's the first consumer edition.

THE ARISTA story is simple and straightforward. Nearly seven years ago, two people with over 35 years experience between them in the electronic accessory industry decided they could build a business based on well-known but little adhered to principles, these were:

1. To produce — from the best available sources, quality/value products which would fill a demand.
2. To develop ranges of product rather than single items, offering a choice of qualities and prices.
3. To diversify, within the electronics industry, as broadly as possible, offering a "one stop" supply within the parameters 1 and 2.
4. To produce annually, a catalogue, which would be considered an industry reference. The criteria for the catalogue was that a) it must be simple to use, b) it must be enjoyable to read, c) it must de-mystify the hype and complexities that build up over electronic products, d) it must offer only products which could sustain demand for at least 12 months and be subject to warranties, support and delivery when requested.

This catalogue is the sixth and latest in the series and we hope you will take time to look at what Arista is all about.

For many of you, the name Arista will be known, but not identified with any particular product, or group of products. The purpose of releasing this edition of the Arista trade catalogue to you, the consumer, is to correct that problem.

Arista Electronics are one of the largest "independent" importers of electronic accessories in Australia. The word "independent" is very important, because it means Arista is not locked into any single brand or product, except their own, ie, Arista. It also means that they have the flexibility to source products from whichever manufacturer, in whatever country they feel is the best available.

What does that mean to you, the consumer?

If Arista were part of another larger buying group, manufacturer, or multinational, they could be forced to take allocated stocks, often against market trends which have been either dumped, returned or overproduced. This is fine for good products, but often the case is that the quality, specifications and performance of these items are unsuited to Australian conditions.

Arista currently sources from manufacturers who supply branded products to leading names like parasound (USA). Roland (Japan), TOA (Japan), Recoton (USA), Sears Roebuck (USA), Philips (Holland) and many others. By having access to major manufacturers, Arista can ensure that the latest and best value products are offered at all times.

Honest Specifications

Arista also believes in being honest with specifications; they often get requests to quote better specifications on products, but will only print genuine specs; eg, RMS watts are the most conservative measure of power, that is what will be quoted — NOTE:

IF RMS = 10 WATTS
THEN PEAK POWER = 20 WATTS
& MUSIC POWER = 30 WATTS

which specifications would you rather see displayed when buying?

Arista specialise in five categories of product which they believe offer the best value available in a price/performance category and we would like to highlight these:

1. **Headphones**
2. **Microphones**
3. **Loudspeakers systems**
4. **PA — Public address**
5. **Mixers**

Headphones.

With 14 models to choose from there is an Arista headphone solution for every need. With the increasing sales of stereo/hi-fi video and TV, more demand is being made for "private" listening eg, the PS-602 pillow speaker, the TV300 stereo/video-TV adaptor or the TVH100 TV-video mini headphones.

The HD82 headphone suits those who want to listen in a noisy environment and require completely covered ears. The new MHD5 jogger phone is specially good for physical exercise and aerobics.

For the compact disc and digital audio listener, the CDS headphones will compare with any brand available at the same price and in two instances, the CDS16 and CDS17 are less than half the price for identical units of major Japanese brands sold in Australia, how much money do *you* pay for a name?

Loudspeaker Systems

Before you write Arista off as a serious speaker supplier, let us point out that they are one of the largest mini-speaker system suppliers in Australia, and have been for over five years.

Have a close look at the MS505W (marine, water proof) mini speakers and try to remember if you have *ever* seen similar offered before at *any* price. Now, problem areas like swimming pools, bar-b-ques, outdoor or salt water areas generally, can be catered for by a pair (or pairs) of mini speakers which actually *sound* and perform to hi-fi standards. The MS501 and 502 mini speaker systems are also legendary in performance for indoor backup use. The MS506 (improved) are one of the best bookshelf systems for the money available, a must when considering a surround sound system.

For the serious listener, the "Triptych" CDS system (compact designed series) offers the latest in speaker technology. Used as a base the CDS806 active (meaning self-amplified) 40 W RMS sub woofer, can

be matched up with any smaller speaker system ie, CDS406, 506, 606 resulting in a sound reproduction normally associated with only the most expensive "brand" name equipment.

The principle

a) Bass is non directional, therefore the CDS806 can be placed anywhere — even behind a lounge, without affecting the deep rich bass sound. Being non-directional or "monaural" only one, not two, CDS806 are used. Being self-amplified, with a separate volume control, perfect bass can be achieved at very low listening levels, ideal for home unit or high density living where neighbours are important to keep as friends.

b) To complete the system the CDS406 mini speakers are hooked up as bookshelf satellites providing the mid range and tweeters. The resulting sound must be auditioned to be believed.

Finally the CDS606 full range speakers offer the best in current technology. A three-way two speaker system — dual wound voice coil, labyrinth enclosure, linear axis on speakers (sloped front), ferro fluid cooled voice coil and soft dome tweeter. **Note** — these identical speakers sell in the USA for around $1000 per pair currently under "known" brand names.

Microphones

No matter whether you are professional, an amateur drama group, or a home recordist, whether you need a microphone for a CB base station, PA system or church fete, Arista has the right solution. Far example, the DM1000 multi-coloured mic set for mobile musicians, the superb DM905 with A KG insert and the DM904D

with Primo insert are much favored by professional stage musicians worldwide, as are the DM902 and DM903.

In the dynamic mics 17 different models as well as a mobile CB and two desk top PA/CB mics are available. Electret condenser microphones like the new ECM2110 offer a super directive feature with minimum background noise interference. Seven further mono, stereo, hand held and tie pin electret condenser mics are also available.

In the wireless microphone section, as well as the professional WFM356 and WMS376 crystal locked system a further six wireless microphones are offered each with a specific character and specification to custom tailor to your needs. There are no less than 50 different microphone accessories including foam windscreens, patch leads, matching transformers, joiners, holders, goose necks, desk and floor stands and adaptors. All in all, as comprehensive a range as offered by any other importer

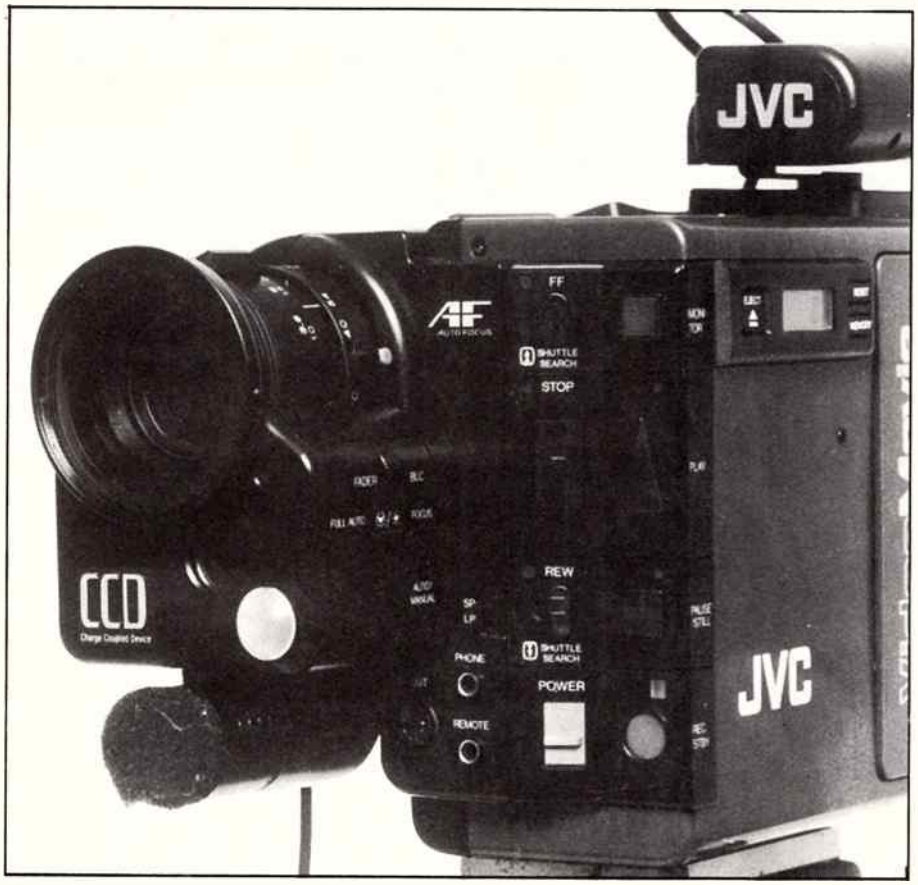
Public Address

Another area where Arista products can stand along with the best in the world is PA (public address). Their megaphones are used from school sports events to political rallys. Buskers use the portable mini PA amps. The PAE 12 and PAE 15 are perfect for boats, schools, squash courts, buses and supermarkets with features such as fog horn, siren, chime, underdash mounting and so on. For more powerful requirements look at the TPA series of amps. Five models cover most installation criteria and the superb new PA background music range including cassette and tuner modules are unique. For big installations the 'PAA' series (three models) and booster amp are ideal. By the time you add all the peripherals and cable plus the tools to do the job it could be said that Arista are one of the major suppliers of PA systems in the country, a fact only installers are currently aware of.

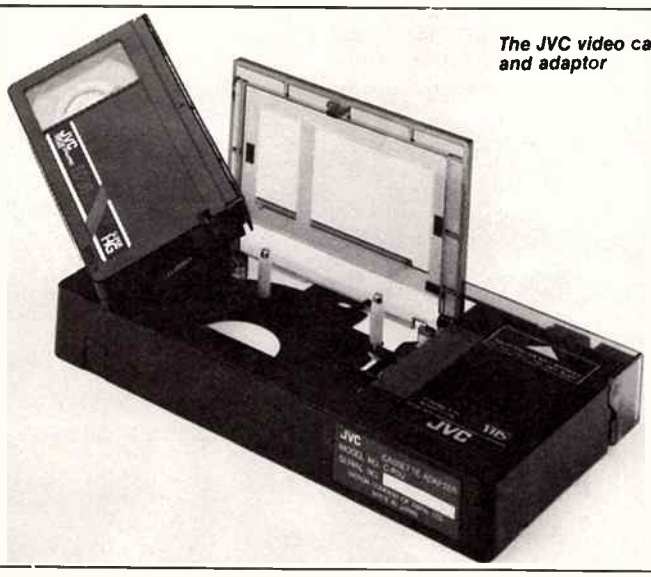
Mixers & Sound

For over five years Arista have been justifiably proud of their range of mixers, FX pedals and sound reinforcement products, including "Cutec" brand. From the smallest garage studio to professional disco operators and recording applications the Arista MM and MX series represent the best technology available anywhere in the world today. Identical units with high profile image names command much higher prices. Once again, Arista is committed to value for your money.

Video Camera Comparison



The JVC GR-C7



The JVC video cassette and adaptor

IN JULY LAST YEAR JVC released the GR-C7 mini cassette VHSC camera recorder. "VHSCs" are tiny VHS cassettes which, when placed into an adaptor, will play in a regular VHS VCR. JVC have developed this small format to compete in the miniturization race that the introduction of video 8 has created. In fact the Sony Video 8 Handycam CCD-V30E is the direct rival of the GR-C7.

Pros and Cons

There are some very interesting pros and cons here. Will the small VHS cassettes become popular because of compatibility with this popular format or will video 8 become the format of the future? Video 8 is definitely superior in quality to VHS, but not quite to the degree that the video 8 people would have us believe. Although the video 8 camp say that their tape is broadcast quality if you put both formats up against broadcast systems, neither measures up. Anyway, quality is not everything. Beta is declining in popularity compared to VHS, although it is superior technically.

When all is said and done however video 8 is more accurate than VHS and is being used for news work in Japan. The band the "Angels" have used video 8 on filmclips and although resolution is low the video information dubs very well. VHS is not as good as this although the GR-C7, JVC claim, has a higher white clip level and a detail enhancer making for a more detailed and balanced image.

JVC GR-C7

First impressions of this machine are astounding. Ordinary users will find just about all the features they need for creative videoing. The little black carry case includes all the accessories you'll need for almost any video connection and application, though I wish they had also included the adaptor for the car battery.

The camera has a couple of very handy features such as: REMOTE START/STOP for record mode which means you don't have to hold the camera, thereby ensuring steady shots; REC REVIEW which quickly shows the last couple of seconds you've shot and returns to the point where you were on the tape (very useful

A brief look at two of the leading contenders in the video market

Phil Witchett

for those with short memory). Finally a counter with a memory (stops at zero in new mode).

The lens is comparable to the video 8 pro. It's an F1.6 with a focal length that zooms between 9 and 54 mm. There is also a macro facility. Unlike other cameras who claim this function, the JVC is true macro right up to the glass. The pickup is CCD (Charge Coupled Device) and gives great resolution. On the negative side the actual record trigger on the camera seemed a little flimsy.

When actually shooting this camera is great. The assemble/edit accuracy is superb. You can quite successfully reform cut edits. Even crash edits work out well. It seems that 12 to 15 frames is the shortest insert/shot available which is fine for reasonable animation. There is an LP (long play) mode for double cassette time (30 min-60 min).

The GR-C7 weighs 1.4 kg and is 121 mm wide, 165 mm high and 223 mm deep.

The small VHS cassette is interesting. You need an adaptor which is an extra and the tape is only 30 mins. However, it means you can play 1st generation tap in a VCR, but I wonder if the first generation factor is of any advantage.

SONY HANDY CAM CCD-V30E

This unit is well constructed. It disassembles into two parts (camera and handgrip). It looks extremely stylish and could actually replace your Cartier watch. The battery fits into the handgrip and as an added bonus, the battery charger doubles as the ac adaptor when power is available, an excellent innovation.

It's zoom is manual only, but very smooth. There is also a macro facility though macro is only able to go as close as 3 inches). It records nicely. The colour definition (hue) is very good, though the GR-C7 has enhanced resolution giving it finer details.

Handycam has the same review function as the GR-C7 and I noticed that with the Handycam you seem to be able to get down to about 8 frames and the shortest shots make it great for animation. I would have liked to have seen a remote start/stop option or for that matter a counter of some kind. Dubbing to another VCR is very accurate and all the connections for the various forms of video input are provided. There is the same LP mode as on the GR-C7 effectively doubling record time. Basically it's got all the essentials.

Shooting with Handycam feels great. It fits in the hand perfectly with great balance. All the controls have a very positive feel and the case is extremely sturdy.

The Sony CCD-V30E weighs 1.4 kg (without the battery) and is 130x155x237 mm.

In comparison with professional gear these new small systems are getting close to broadcast quality. ●

The Sony CCD-V30E

Reviews

Compact Discs reviewed on this page supplied by Angel Compact Discs. Phone (02) 253-3690

Artist — Michael Jackson
Title — BAD
Producer — Quincy Jones
Label — Epic
Cat No — CDEPC 450 290 2

In the time since his last release (Thriller) Michael Jackson has spawned a veritable industry of artists (some good, some terrible) all chasing the 'Pot of Gold' at the end of his rainbow.

With the release of *Bad* their master is back and back with a vengeance. The team of Jackson and producer extraordinaire Quincy Jones deliver with consummate, almost other-worldly ease, an album of technical and musical mastery.

Jackson is finally stretching his lyrical emotional depth and *Bad* displays a marked increase in maturity over his previous work while still maintaining a firm finger on the teenage music market pulse.

The eleven tracks (including an extra one not contained on the album or cassette) on this CD vary considerably in style, but all contain that Jackson magic. Whether it is his emotive androgynous vocals or the sheer infectious enthusiasm imparted one can only feel admiration for this eighties megastar who provides us with his labours of love (surely he doesn't do it for the money) all too infrequently.

The better tracks are *The Way You Make Feel* solid drumming and beat with tasteful brass usage and a strong chorus line; *Speed Demon* a funky upbeat technical (programming and sequencing) tour de force; *Liberian Girl* a slower, hypnotic more emotional song with a sparse synthesiser feel; *Man In The Mirror* a big production vocal number with a strong beat and great harmonies; *I Just Can't Stop Loving You* a vocal duet minor classic with a terrific chorus; *Dirty Diana* clever use of dynamics and effects make this the rockiest track with a raunchy guitar solo provided by Steve Stevens (Billy Idol's band).

It should be said that all tracks have merit. With the cast of talent rivalling a DeMille production that Jackson as assembled, so it should.

Bad it's called, great it is.

Mark Lewis

Artist — Various
Title — The Young Wolfgang Amadeus Mozart
Producer — Tom Parker
Label — RCA
Cat No — PD 71161

Ever since the release of the play and film *Amadeus* Mozart and his music have been undergoing something of a popular revival. There has been a virtual cascade of books about the young composer's life and new recordings of his music. This album is the latest in the series. It consists of a number of Mozart's popular musical pieces supposedly adapted for modern taste by the inclusion of new lyrics and electric instruments. In answer to the purists who may be offended by this treatment of the master's work Tom Parker (the producer) claims, in a note on the jacket of the album, that (Mozart's) "works can be successfully modernised, without sacrificing the original feeling behind them."

Unfortunately this may have been Mr Parker's intention but it certainly does not come across on the disc. In fact the only word to describe *The Young Wolfgang Amadeus Mozart* is gross. Not only does the listener have to put up with lyrics referring to such things as "neon lights" but also inept singing and sometimes a complete lack of understanding about the original work. Take for example the first track on the disc entitled *You Know Him Well* which is the updated version of the famous *Voi Che Sa Petta* sung by the page Cherubino in the opera *The Marriage of Figaro* (1786). This song refers to the love the young page is feeling for his mistress the Contessa Rossina. It is traditionally sung by a soprano and is meant to be a lively little number in the humorous vein of the Opera generally. On this recording a delightful piece becomes a dirge, sung in a painfully slow and simplified fashion by Madeline Bell.

One could forgive one error of interpre-

★★★★ Don't miss it
★★★ Value for money
★★ Please miss it
★ Watch the microwave instead

tation if it was the only one on the album, unfortunately there are many such errors. Then there is the singing. It is simply appalling, the most lasting impression is of breathy voices with little range, although to be fair this may be more a comment on Mr Parker's abilities as producer rather than the singers.

In short the *Young Mozart* is a musical failure, however it may well be a commercial success. There is always a market for such albums as these in telephone holding systems or airport waiting rooms.

Simon O'Brien

Title — RUTHLESS PEOPLE
Distributor — Walt Disney
Length — 90 minutes
Rating — M
Standard — ★★★★

If Bette Midler is not the comedienne of the decade, then who is next in line? This outrageous lady dominates this superb comedy from beginning to end as she stars as the shrewish wife of a sleazebag businessman. She is kidnapped but, understandably perhaps, her husband is loath to pay the ransom for her return. Evidently, he hasn't heard her sing. The kidnappers, an inept pair, end up bargaining for the ransom, but still to no avail. One of the best comedies of the year and a movie that bears constant re-viewing. Midler, who recently starred in another great comedy "Outrageous Fortune", is truly a great star. Highly recommended.

Peter Brown

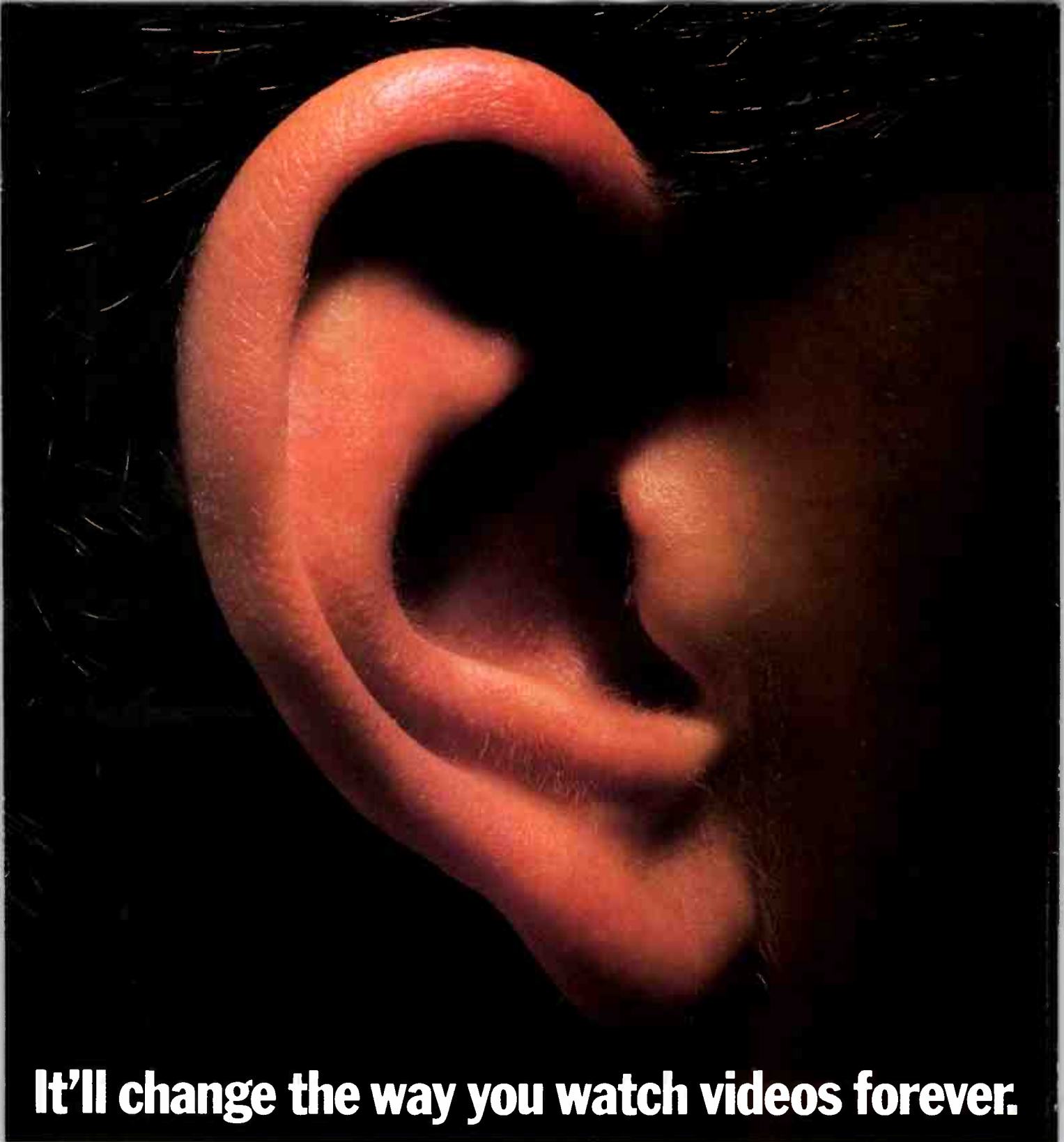
Title — THE JOLSON STORY
Distributor — RCA Columbia
Length — 125 minutes
Rating — G
Standard — ★★★★

OK, I know this is not a recent release, having hit the shelves some months ago, but such is the power of this gem, it certainly deserves a mention.

Everyone thought Harry "King" Cohn, then boss of Columbia Studios, was a fruitcake when he proposed making this movie. At this stage, Jolson was a forgotten man, diseased, neglected and seemingly talentless while the crooners were the rage. This one movie, not just for hiring, but for outright purchase, this classic is one of two movies that just don't date. No prizes for guessing the other flick. The songs are great, the dialogue is good and corny and for the astute, you can even spot the real Jolson in one scene.

Peter Brown

Peter Brown
Peter Brown has been a journalist for 20 years. In addition to his writing, he has lectured on films for two years. He has also run film festivals and has a penchant for German silent films, W. C. Fields, Mischa Bakaleinikoff, John Barrymore and anything even reeking faintly of Irving Thalberg. He is also, despite protestations from the editor, contemplating creating a film quiz for the aficionadoes.



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5 YEAR WARRANTY.

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READER INFO No. 27

* Rec. retail price.

```
00100 FO$="":STRS(8000):DIM ZO(10):A1$=""
00110 CLS
00120 UNDERLINE:PRINT:CURS 24,1:PRINT"WE'RE EMPTY !"
00130 SPEED 50:PRINT
00140 NORMAL:PRINT"You are flying over a city in your helicopter
but you have no t "
00150 PRINT"enough fuel to get away from it to land. The helicoptor you are"
00160 PRINT"flying is an army helicopter full of bombs.  You must bomb the "
00170 PRINT"city and land there."
00180 PRINT"Your helicopter will get lower and lower as the game goes on,  "
00190 PRINT"so bomb the tall buildings first so as not to crash into them."
00200 PRINT:PRINT"Use the SPACEBAR to fire bombs."
00210 PRINT
00220 SPEED 0
00230 CURS 30,16:PRINT"Hit any key to continue...";
00240 IF KEY=""THEN 240
00250 RESTORE 310:X=64:Z=0
00260 CLS:CURS 10,7:PRINT"''Oh, no'' We're "¦:UNDERLINE:PRINT"empty";
:NORMAL:PRI NT"!!''''"¦:FOR I=-448 TO -433:POKE I,0:NEXT I
00270 FOR I=64960 TO 65007:READ A:POKE I,A:NEXT I
00280 FOR I=65040 TO 65087:READ A:POKE I,A:NEXT I
00290 FOR I=0 TO 10164:CURS I:PCG:PRINT"d";:NORMAL:NEXT I
00300 PCG:FOR I=64 TO 57 STEP -1:CURS I,1
00310 DATA 0,63,0,7,12,24,48,32,32,32,48,31,15,7,2,15
00320 DATA 0,254,128,240,120,124,126,127,127,126,126,252,248,240,32,248
00330 DATA 0,0,0,0,0,3,3,255,255,3,3,0,0,0,0,0
00340 DATA 0,0,0,7,12,24,48,32,32,32,48,31,15,7,2,15
00350 DATA 0,128,128,240,120,124,126,127,127,126,126,252,248,240,32,248
00360 DATA 0,0,0,0,0,3,3,255,255,3,3,0,0,0,0,0
00370 RESTORE 380:FOR J=65440 TO 65455:READ A:POKE J,A:NEXT J
00380 DATA 255,255,255,255,255,255,255,255,255,255,255,255,255,255,255,255
00390 ZO$(0)="dzzzddddddddzzzddddddddddddddddddzzzzzz"
00400 ZO$(1)="dzzzddzzzzdzzzddddzzzzddddddddddddzzzzzzddddddddzzzzzzzzzzz"
00410 ZO$(2)="dzzzddzzzzdzzzddddzzzzdzzzzddddddzzzzzzddddddddzzzzzzzzzzz"
00420 ZO$(3)="dzzzddzzzzdzzzddddzzzzdzzzzddddddzzzzzzddddddddzzzzzzzzzzz"
00430 ZO$(4)="dzzzddzzzzdzzzddddzzzzdzzzzdzzzzddddddddzzzzzzzzzzz"
00440 ZO$(5)="dzzzddzzzzdzzzddddzzzzdzzzzdzzzzdzzzzddzzzzddzzzzzzzzzz"
00450 ZO$(6)="dzzzddzzzzdzzzddddzzzzdzzzzdzzzzdzzzzddzzzzddzzzzzzzzzz"
00460 ZO$(7)="dzzzddzzzzdzzzddddzzzzdzzzzdzzzzdzzzzddzzzzddzzzzzzzzzz"
00470 IF I=64 THEN PRINT"\";
00480 IF I=63 THEN PRINT"\]";
00490 IF I<63 THEN PRINT"\]^";
00500 OUT 2,64:OUT 2,0
00510 CURS I+3,1:PCG:PRINT"d";
00520 NEXT I
00530 PCG:CURS 57,1:PRINT"\]^":NORMAL
00540 FOR I=0 TO 7:PCG:CURS 1,I+8:PRINTZO$(I);:NEXT I
00550 NORMAL:CURS 25,16:PRINT"Hit any key to start...";
00560 A1$=KEY:IF A1$="" THEN 560
00570 CURS 25,16:PRINT"                    ";
00580 J=ASC("z"):L=ASC("d"):M=140:REM J SKYLINE,L BLANK,M BOMB
00590 X=57:Y=1 :REM STARTING POSTITION OF PLANE
00600 IF V=J THEN 770
00610 IF KEY$=" " THEN  640
00620GOSUB 800
00630GOTO610
00640 C=X:D=Y
00650 CURS X,Y:GOSUB 800: D=D+1
00660 IF D>15 THEN 620
00670 CURS C,D:GOSUB 790
00680 IF V<>L THEN CURS C-1,D:PCG:PRINT"ddd";:GOSUB 860:PLAY 1:NORMAL:GOTO 620
00690 PRINT CHR(M);:NORMAL:CURS C,D:PRINT CHR(L);:GOTO 650
00700PCG:CURSA-1,B:PRINT"ddddd";:F=2
00710CURS1,15:PCG:PRINT"\]^d";:FORI=0TOF:NEXTI:CURS1,15:PRINT"abcd";
00720OUT2,64:OUT2,0:F=F+2
00730IFF=140THEN740ELSE710
00740CURS1,15:PRINT"\]^";:NORMAL
00750 CURS 12,2:PRINT "Congratulations, you made it":PLAY 16;16;20;23;0;
20;23,8; 0,5:CLS:END
00760 PRINT CHR(255);:CURS 1,2:PRINTSPC(64)
00770 CURS 21,2:PRINT"You crashed"
00780 GOTO 890
00790 W=PEEK(267)+PEEK(268)*256:V=PEEK(W):RETURN
00800 IF X=2 AND Y=15 THEN 710
00810 A=X:B=Y:X=X-1:IF X<1 AND T=4:X=1:CURS X,Y:PCG:PRINT"ddddd":Y=Y+1:A=57:
T=1: IF Y>14 AND X=1 THEN 700 ELSE IF X<1:T=T+1:X=57:PCG:CURS X,Y:PRINT
"ddddd":NORMAL
00820OUT2,64:OUT2,0:IFH=1:H=0ELSELETH=1
00830CURS X,Y:GOSUB 790:IF V=J THEN CURS X,Y:PCG:PRINT"z]^d";:NORMAL:GOTO 770
00840PCG:CURSA,B:PCG:PRINT"ddddd";:CURS1,Y:IFH=1THENPCG:PRINT"\]^";:
NORMALELSEPCG:PRINT"abc";:NORMAL
00850 RETURN
00860 CURS C-1,D-1:U=PEEK(267)+PEEK(268)*256:V=PEEK(W):IF V=J
THEN FOR I=D-1 TO 8 STEP -1:CURS C-1,I:PRINT"d";:NEXT I
00870 CURS C+1,D-1:W=PEEK(267)+PEEK(268)*256:V=PEEK(W):IF V=J THEN FOR
I=D-1 TO 8 STEP -1:CURS C+1,I:PRINT"d";:NEXT I
00880 RETURN
00890 Y=Y+1
00900 CURS X,Y:W=PEEK(267)+PEEK(268)*256:V=PEEK(W)
00910 Y=Y+1:CURS X+1,Y:W=PEEK(267)+PEEK(268)*256:F=PEEK(W)
00920 IF V=J OR F=J OR Y=16 THEN 930 ELSE CURS X,Y-1:PCG:PRINT"dd";:CURS X,
Y:PRI NT"]^";:NORMAL:GOTO 900
00930 FOR C=24 TO1 STEP-1:PLAY C:NEXT C
```

Chopper Game

This is a program using PCG. The game has instructions in it so it is self explanatory.

To create an illusion of movement for the helicopter you are flying I have designed two helicopters, each with their blades in a different position. These helicopters are swapped every time it moves forward.

To achieve the PHUTT PHUTT sounds for the helicopter I have used OUT 2, 0:OUT 2,65.

When you play the game you will notice that you cannot drop bombs continuously. This is because the program would have to be a lot longer and slower to keep track of all the bombs at once.

S. Wilkey,
Normanhurst,
NSW

```
00100 REM     ************************************************
00110 REM     *                DRAWING                       *
00120 REM     *       CHRIS GORE      AUGUST 1987            *
00130 REM     ************************************************
00140 C=255:D=127:A2$="":E=0
00150 OUT1,79
00160 HIRES2
00170 A=IN(0)
00180 A1$=KEY$
00190 IF A1$="l" OR A1$="L" THEN LET A2$="L"
00200 IF A1$="R" OR A1$="r" THEN LET A2$="R"
00210 IF A2$="R" THEN GOSUB 420
00220 IF A2$="L" THEN GOSUB 290
00230 IF A1$="e" OR A1$="E" THEN CURS1:PRINT "ERASE"; ELSE CURS 1:PRINT" ";
00240  REM  Joystick controlled lines
00250 GOSUB 540
00260 B=(A AND 128):IF B=0 THEN IF A1$="e" OR A1$="E" THEN RESET C,DELSE
IF B=0 THEN SET C,D
00270 GOTO 170
00280  REM  Line drawing routine
00290 CURS1:PRINT"LINE";
00300 A=IN(0)
00310 GOSUB 540
00320 A=IN(0)
00330 B= (A AND 128):IF B=0 AND E=1 THEN PLOT C,D TO F,G:GOTO 380
00340 IF B=0 AND E=0 THEN LET E=1:F=C:G=D:SET C,D:CURS6:PRINT"SET";
00350 A=IN(0)
00360 B=(A AND 128):IF B=0 THEN 350
00370 GOTO 300
00380 CURS1:PRINT"          ";
00390 A2$="":E=0
00400 RETURN
00410  REM  Rectangle drawing routine
00420 CURS1:PRINT"RECT";
00430 A=IN(0)
00440 GOSUB 540
00450 A=IN(0)
00460 B=(A AND 128):IF B=0 AND E=1 THEN PLOT C,D TO C,G TO F,G TO F,D TO C,
D:GOT O 510
00470 IF B=0 AND E>0 THEN LET E=1:F=C:G=D:SET C,D:CURS6:PRINT"SET";
00480 A=IN(0)
00490 B=(A AND 128):IF B=0 THEN 480
00500 GOTO 430
00510 A2$="":E=0:CURS1:PRINT"          "
00520 RETURN
00530  REM Cursor moving subroutine
00540 B=(A AND 1):IF B=0 THEN LET D=D+1
00550 B=(A AND 2):IF B=0 THEN LET D=D-1
00560 B= (A AND 4) :IF B= 0 THENLET C=C-1
00570 B=(A AND 8):IF B=0 THEN LETC=C+1
00580 IF C<1 THEN LET C=1
00590 IF C>510 THEN LET C=510
00600 IF D<1 THEN LET D=1
00610 IF D>254 THEN LEI D=254
00620 INVERT C+1,D:INVERT C-1,D:INVERTC,D-1:INVERT C,D+1
00630 INVERT C+1,D:INVERT C-1,D:INVERTC,D-1:INVERT C,D+1
00640 RETURN
```

Drawing

This is a drawing program for the premium series Microbee and uses the joystick to control the cursor. It has three modes of drawing.

The first is a "freehand' mode, it will draw as long as the fire button on the joystick is depressed. If the fire button isn't pressed the joystick will only move the cursor.

The second mode allows you to draw lines between two points. Press the "L" key and the word "LINE" will appear move the cursor to the start of the line and press the fire button, the word "SET" should appear. Move the cursor to the other end of the line and press the fire button again. A line will be plotted between the two points.

The third mode draws rectangles. It is similar to the line drawing routine. Pressing "R" will enable this mode, the joystick is then used to set the two opposing corners of the rectangle in a similar manner to setting the points in the line drawing routine. The rectangle will then be plotted.

Lines can be erased by holding down the "E" key and moving the joystick with the fire button pressed.

C. Gore,
Yangebup,
WA

```
00100 REM              ** Invasion Force **
00110 REM                    ** Ver 2 **
00120 REM
00130 REM      Writen by Norman Tee & C. Illic,
00140 REM
00150 GOSUB630
00160 T=1000:H=0
00170 F=10
00180 J=0
00190 CLS
00200 LORES:PLOT 0,2TO127,2
00210 PLOT 0,2TO18,25TO29,13
00220 PLOT 0,45TO127,45:PLOT 0,38TO127,38
00230 PLOT 0,2TO50,20TO60,2TO80,20TO84,2TO110,30TO125,2
00240 X=1:Y=5
00250 P=INT(RND*61)-2
00260 IFP=0THENGOTO190:IFP=1THENGOTO190:IFP=2THENGOTO190
00270 IFP=3THENGOTO190:IFP=4THENGOTO190
00280 CURSP,15:PRINTCHR(158);CHR(173)
00290 NORMAL:X=X+1:T=T-1:CURS3,3:PRINT"TIME IS";T
00300 CURS3,2:PRINT"COMMENTS: "
00310 CURS31,3:PRINT"YOU ";X+2
00320 CURS40,3:PRINT"ALIEN ";P
00330 CURS51,3:PRINT"SCORE ";J
00340 CURS17,3:PRINT"ALIEN HIT ";H
00350 GOTO460
00360 IFH=0THENCURS20,2:PRINT"Must have been a stowaway!!":PLAY1;2;3;13;14;5,4
00370 IFH>10ANDH<20THENCURS20,2:PRINT"A planet defender ":PLAY0,10
00380 IFH>1ANDH<5THENCURS20,2:PRINT"Another stowaway!!":PLAY1;2;3;4;1;2;3;4;5;6;7
00390 IFH>5ANDH<10THENCURS20,2:PRINT"Crewman":PLAY0,10
00400 IFH>20ANDH<30THENCURS20,2:PRINT"A star fleet commander !":PLAY0,10
00410 IFH>30ANDH<40THENCURS20,2:PRINT"General five star":PLAY0,15
00420 IFH>40ANDH<50THENCURS20,2:PRINT"Super star !!":PLAY0,15
00430 IFH>50THENCURS20,2:PRINT"Unbelievable !!!!";CHR(174);CHR(157)
00440 PLAY13,3;13,3;11,3;13,3;9,3;13,4;11,3;9,4
00450 CURS26,13:PRINT"G A M E  O V E R":PLAY1,4:PLAY0,15:GOTO780
00460 IFT=0THENPLAY4,2;4,2;4,2;1,5:GOTO360:END
00470 IFX=60THEN190
00480 IFX=P-2THENPLAY10
00490 CURSX,Y:NORMAL:PRINTCHR(32);CHR(137);CHR(166);CHR(153);CHR(134);CHR(32);
00500 NORMAL
00510 K1$=KEY:IFK1$=" "THEN530
00520 GOTO280
00530 FORB=7TO15:OUT2,0:OUT2,65
00540 CURSX+2,B:PRINTCHR(170);CHR(149);
00550 NEXTB
00560 IFX=P-2THEN580
00570 GOTO190
00580 CURSP-2,15:PRINTCHR(164);CHR(167);CHR(155);CHR(152)
00590 PLAY1,3;2;4;1;3
00600 H=H+1
00610 J=J+F
00620 GOTO190
00630 CLS:LORES:FORI=1TO64:CURSI,1:PRINTCHR(191);:NEXTI
00640 FORD=1TO15:CURS1,D:PRINTCHR(191);:NEXTD
00650 FORA=1TO64:CURSA,15:PRINTCHR(191);:NEXTA
00660 FORU=15TO1STEP-1:CURS64,U:PRINTCHR(191);:NEXTU
00670 CURS24,3:PRINT"** Invasion Force **"
00680 CURS3,5:PRINT"The object of the game is to blast the ALIEN Missile "
00690 CURS3,6:PRINT"You must hit directly in the centre of him ! "
00700 CURS3,7:PRINT"The ALIEN can blend in with the landscape."
00710 CURS3,8:PRINT"Use the SPACE BAR to fire the LASER"
00720 CURS3,9:PRINT"A pip means you are directly over the target."
00730 CURS15,11:PRINTCHR(137);CHR(166);CHR(153);CHR(134);" YOUR SHIP"
00740 CURS16,13:PRINTCHR(158);CHR(173);" ALIEN MISSILE"
00750 CURS22,15:PRINT"PUSH SPACE BAR TO START"
00760 IFKEY=" "THEN770ELSE760
00770 RETURN
00780 CLS:LORES:PLOT 0,0TO127,0TO127,47TO0,47TO0,0
00790 CURS20,2:PRINT"NUMBER OF ALIENS YOU HIT WAS";H;
00800 CURS22,8:PRINT"PUSH Y/N FOR ANOTHER GO ?"
00810 K1$=KEY:IFK1$=""THEN810
00820 IFK1$="Y"THENGOTO160
00830 IFK1$="N"THENPOKE164,0:USR(32768):REM Auto Boot.
00840 IFK1$="$"THENEND
00850 GOTO810
```

Letters

Let's see some more 'guts' back in the magazine articles that go deeper, not just scratch the surface. Sept. ISDN article is a good example. This technology is very important to all persons in the electronics industry today — so let's hear a bit more about what it's about!

Generally, however, a good mag, worth reading. Bit less politics, though, huh?

P.S. Sept. 'Line Switcher' article great — top marks to Ian Thomas.

Phillip Dimond
Alexandria
Sydney, NSW

I just received my first issue of ETI today and compared with other magazines it is very good value.

There is a definite need for some articles on cheaper speakers for under $50

Jamie Tufrey
Narrabri,
NSW

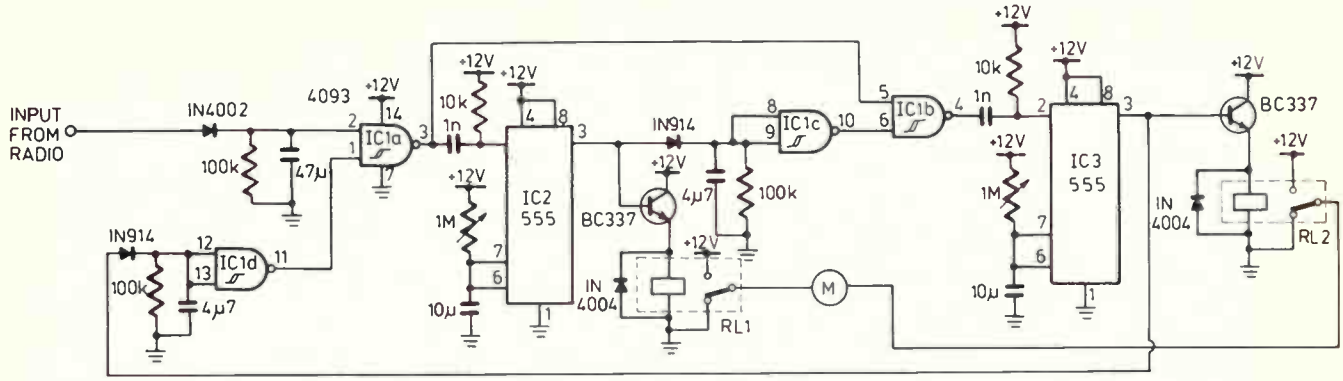
Minimart

FOR SALE VZ 200/300 users short basic program. Save Binary Programs to tape and disc. Send $5 to P. Brennan, P.O. Box 334, Mordialloc, Vic 3195.

For Sale, Compact Disc Service Manuals and Technical Manuals with detailed Technical descriptions worth $150 plus. Sell $15. Phone Ken on (02) 645-4060 after 6pm.

FOR SALE: PLUG PACK TYPE POWER supply. Suitable for numerous projects. 240 Volts ac to 9.5 volts dc at 1.1 amps. $12.00 each plus $4.00 P&P Don McKenzie 29 Ellesmere Cres, Tullamarine 3043.

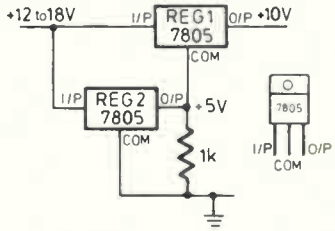
FOR SALE: Vectorscope and Waveform monitor, matched pair, excellent professional model made by Systems Video in England. $3850 for both. Phone Ross on (07) 801-1327.



Automatic antenna controller

This controller is designed so that it can never get confused. The motor can never reverse direction until the antenna is either fully up or fully down. The NAND gates are arranged so that only one 555 can operate at any one time.

L. Kater,
Laverton,
Victoria



A regulated 10 Volt Supply

Some circuits require a regulated 10 volt supply, but three terminal regulators for 10 volts are few and far between. Simple arithmetic says that 5+5=10, so why not use a pair of 5 volt regulators.

If the regulators are to be run hot, then they need heat sinking, however this could lead to disaster, as the centre pin of the regulators are attached to their metal body, hence the heat sink. So use either two separate heat sinks, or mica spacers and plastic bolts.

Regulator #2's output is 5 volts above ground and the output of regulator #1 is 5 volts above its ground. This is 10 volts above the ground.

P. E. O'Connell
Oatley,
NSW

Feed Forward needs your minds. If you have ideas for circuits that you would like to enter in our idea of the month contest, programs for the computing columns or just want a word with the editor, send your thoughts to:

Feed Forward
ETI, Federal Publishing,
PO Box 227,
Waterloo, NSW 2017

Contributors can look forward to $20 for each published idea/program which should be submitted with the declaration coupon below.

Programs MUST be in the form of a listing from a printer. You should indicate which computer the program is for. Letters should be typewritten or from a printer, preferably with lines double spaced. Circuits can be drawn roughly, because we have a draughtsman who redraws them anyway, but make sure they are clear enough for us to understand.

'Idea of the month' contest

Scope Laboratories, which manufactures and distributes soldering irons and accessory tools, is sponsoring this contest with a prize given away every month for the best item submitted for publication in the 'Ideas for Experimenters' column — one of the most consistently popular features in ETI Magazine. Each month, we will be giving away a Scope Soldering Station (model ETC60L) worth approximately $191.

Selections will be made at the sole discretion of the editorial staff of ETI Magazine.

RULES

The winning entry will be judged by the Editor of ETI Magazine, whose decision will be final. No correspondence can be entered into regarding the decision.

The winner will be advised by telegram. The name of the winner, together with the winning idea, will be published in the next possible issue of ETI Magazine.

Contestants must enter their names and addresses where indicated on each coupon. Photostats or clearly written copies will be accepted. You may send as many entries as your wish.

This contest is invalid in states where local laws prohibit entries. Entrants must sign the declaration on the coupon that they have read the above rules and agree to abide by their conditions.

COUPON

Cut and send to: **Scope-ETI 'Idea of the Month' Contest/ Computing Column, ETI Magazine, PO Box 227, Waterloo NSW 2017.**

"I agree to the above terms and grant *Electronics Today International* all rights to publish my idea/program in ETI Magazine or other publications produced by it. I declare that the attached idea/program is my own original material, that it has not previously been published and that its publication does not violate any other copyright."*

* Breach of copyright is now a criminal offence.

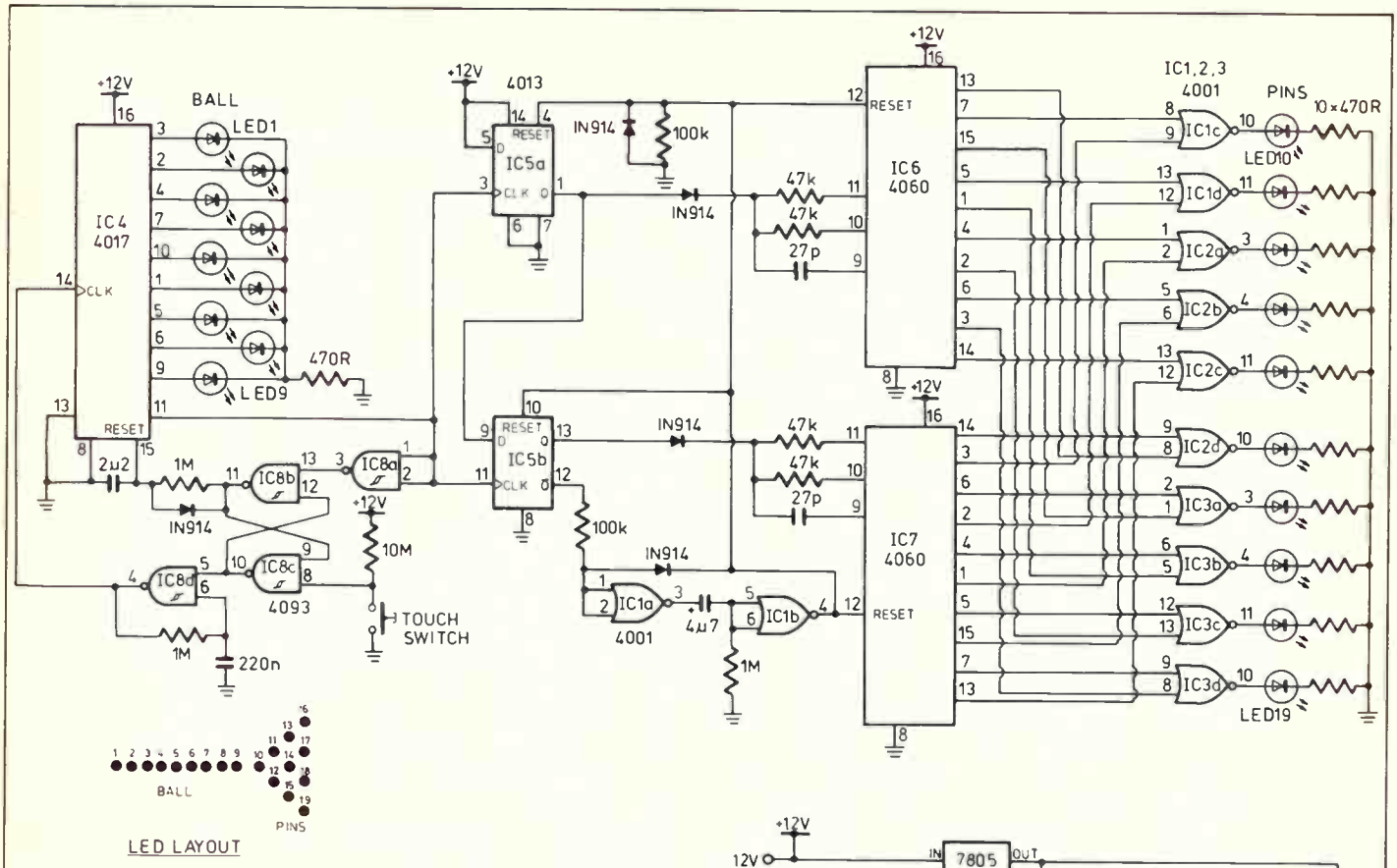
Title of idea/program .....

Signature ..... **Date** .....

Name .....

Address .....

..... **Postcode** .....



LED LAYOUT

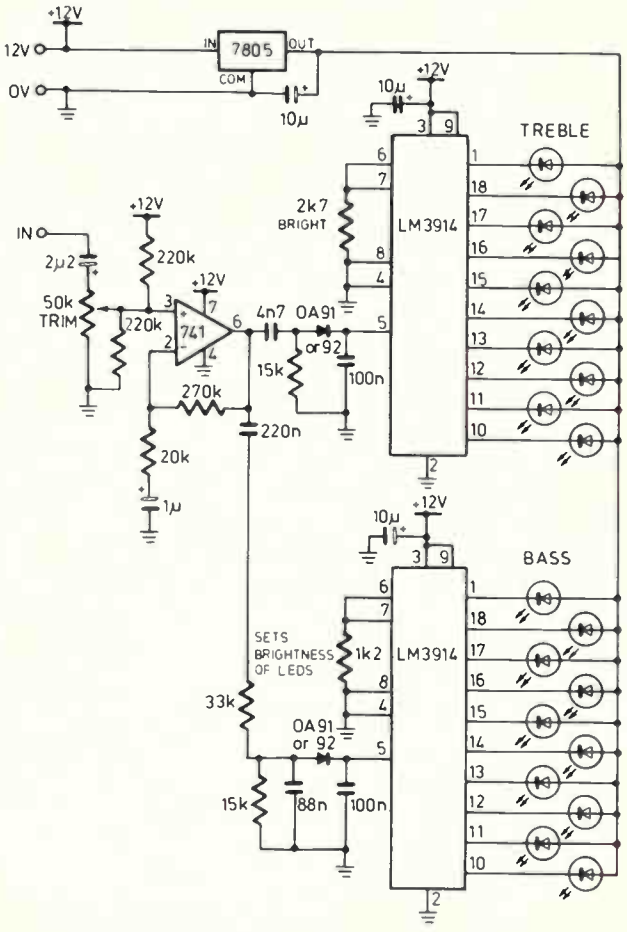
Ten Pin Bowling Game

Initially IC6&7 are clocking at high speed and LEDS 10-19 are lit. LED1 is also lit.

Touching the touch switch flip-flop IC8b and IC8c and enables clock IC8d. IEDS 1-9 light in sequence until pin 11 IC4 goes high. This resets the flip-flop and after a couple of seconds delay IC4 is reset and LED1 lights up again simulating ball return. At the same time IC5a is clocked and pin 1 goes high and disables the clock of IC6. This causes a random binary output to turn some of LEDS10-19 off simulating pins falling. Touching the switch again causes the same sequence but this time pin 13 IC5b goes high disabling the IC7's clock. This causes more LEDS to go out. After a time determined by the monostable IC1a and IC1b, IC's 5, 6 and 7 are reset and the game is ready for the next bowler.

Scoring is done exactly the same as real bowls.

L. Kafer,
Laverton,
Victoria.



Bass and Treble Meters

This simple LED meter shows bass and treble levels using two LM 3914 and one 741 op-amp. Use red LEDs for the bass and green for the treble. The 50 k trim pot sets the input sensitivity.

A. Taylor,
Mulgrave
Victoria

Military Software

Software for the Frequency Management Processor (FMP), which forms an integral part of the Australian Army's $350 million tactical communications system "Project Raven", has passed acceptance tests two months ahead of schedule. A team from Computer Sciences of Australia, has spent the last two years designing and developing the software.

"Project Raven" will enable the army to maintain greater security over radio communications in the field, improve the quality of communication and cause minimum interferance to other radio users.

CSA worked as a subcontractor to Plessey which is supplying all equipment including manpack HF transceivers, manpack VHF transceivers, RF power amplifiers, ancillaries and message-entry devices.

The FMP is a militarised VAX minicomputer which will be mounted in a mobile shelter for deployment at the battlefield.

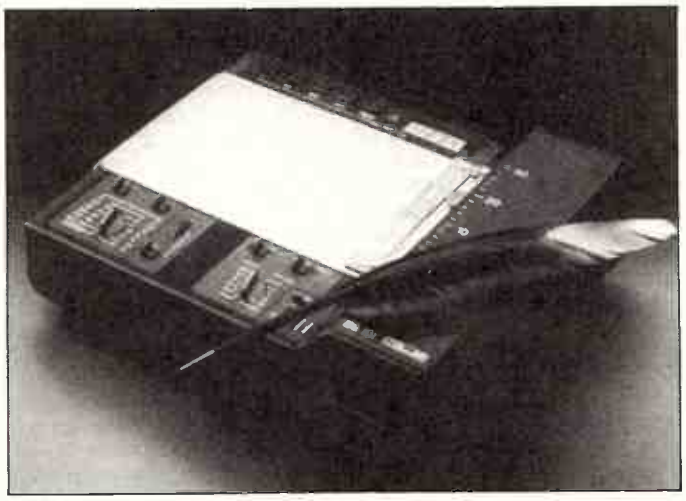
Its task is to assign, distribute and manage radio frequencies as well as data for associated signal operating instructions. These coded instructions are used by the army to assign frequencies for single channel radios in the field.

The FMP will also plan and allocate frequencies throughout the battlefield to maximise interference-free communication and provide security from enemy intelligence operations.

Software developed by CSA takes into account the varying characteristics of all the radios that will be used in the battlefield by the army. Mr Brian Lovelock, CSA's Systems Engineering Manager, said: "A unique and innovative feature of the FMP system is the generic sub-system which includes a database of typical military formations, units and sub-units."

R.I. No. 141

Portable Recorder

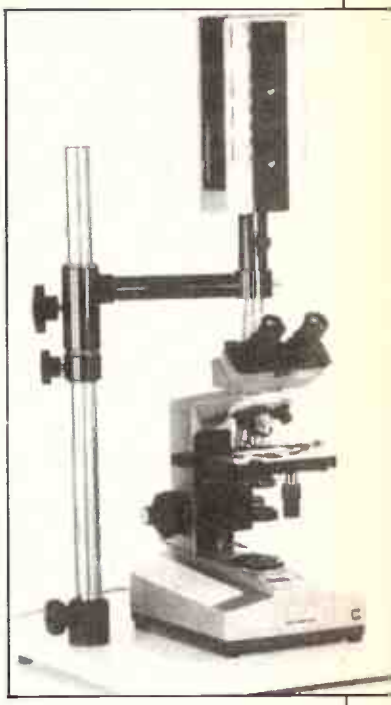


Kent Instruments have released the GOERZ/METRAWATT SE110 and SE111 battery/mains operated chart recorders. These instruments feature digital display of measured value plus chart printing of measuring range and chart speed as a standard feature.

The SE110 offers 18 switch-selectable dc voltage ranges commencing at 1 mV dc full scale, with calibrated zero suppression up to 200%. The SE111 has 48 calibrated ranges from 150 mV to 750 Vdc/ac and 0.6 mA to 6 Adc/ac.

Operation is by on-board batteries, external 12 Vdc or mains supply. 12 chart speeds from 1cm/hour up to 600cm/minute are provided. A range of accessories such as shunt resistors and clip-on current transformers are also available.

R.I. No. 142



Coupling Microscopes

Warsash have released the series 2500-5000 TV-Microscope Couplers, which connect any black and white or color closed circuit TV camera to almost any microscope.

The couplers contain well corrected, coated optics and an adjustment knob to bring the TV monitor into focus at the same time the eyepieces are in focus. This "parfocality" control is said to be of great help with a stereo zoom microscope, eliminating the need for drastic re-focusing when the microscope is zoomed to a different magnification. Having a magnification of 1x, the series 2500 coupler is best suited for general microscope usage, covering a large part of the field of view as seen through the eyepieces.

The series 5000 has a magnification of 2x and is used when higher magnification is needed to achieve the maximum resolving power of the microscope. A "C" mount thread that first most TV cameras is supplied as standard equipment.

R.I. No. 143

New Method Of Solving Problems

To help solve the problems that occur due to intermodulation distortion which happens when the transmit signals of various transmitters of different frequencies mix with each other, Radio Frequency Systems of Kilsyth, Victoria have developed a computer program that can analyse the effect of up to 100 different transmitters on up to 100 different receivers.

The hard copy print-out defines signal frequencies that may cause problems to the receiver. With this information the necessary precautions in form of bandstop or bandpass filtering can be taken.

RFS will supply this analysing service at a nominal low fee to customers or others interested. RFS can also supply the necessary filtering networks. *R.I. No. 103*

Philips Introduces Retrofit Interfaces

Philips Test & Measurement claims to have increased the versatility of its PM 2534/35 digital multimeters and PM 8272/71 XY/XT recorders by the introduction of RS232-C and digital-to-analogue interfaces.

The PM 9190 RS232-C/V24 interface provides an economic interfacing solution for use with the PM 2534 and PM 2535 digital multimeters. This interface allows the multimeter to be controlled by a PC or other computer fitted with an RS232/V24 interface.

It also allows the multimeter to be connected directly to a serial printer for hard-copy registration of DMM measured values. Another valuable feature of this serial interface is its multidrop mode, which allows the multimeter to be used as one of several devices connected in the same serial link. Commands are directed to individual instruments using a simple sequential addressing procedure.

The PM 9193 analogue interface allows the display values of the multimeter to be output to a recorder for direct plotting. The desired groups of 3 or 4 display digits can be selected by switch settings on the interface, to suppress significant digits and optimize information content and resolution.

This analogue interface can be particularly valuable in applications in which it is desired to measure RMS values with higher accuracy than can be provided by a recorder alone. This problem can be overcome by the use of a DMM fitted with the PM 9193 analogue output, when the facility for selection of groups of display digits allows the resolution and accuracy to be increased as required.

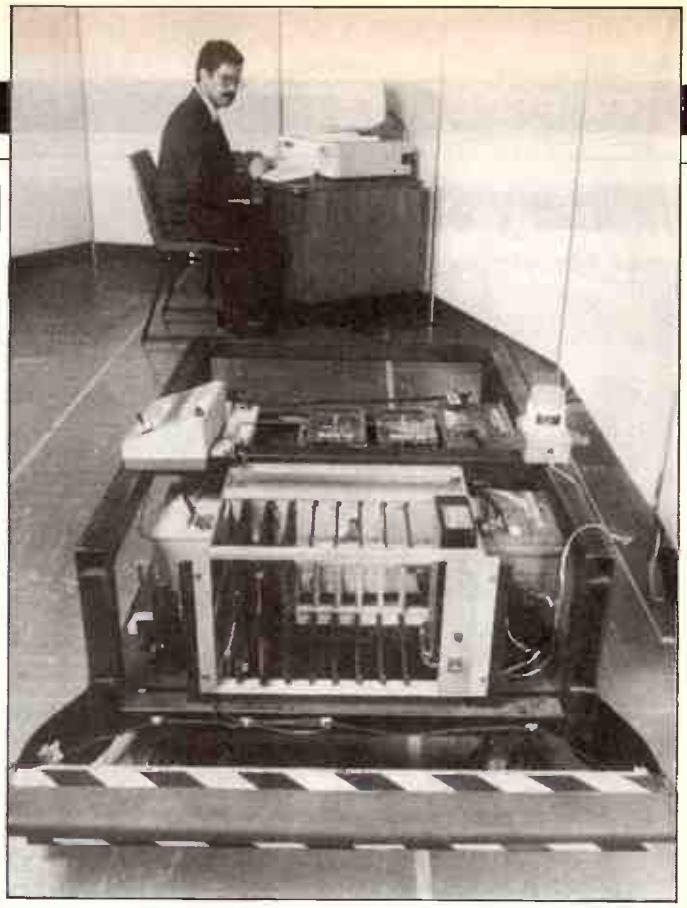
The display polarity indicator of the multimeter can be monitored, giving an indication of signal polarity together with the measured value from the display. If required, a signal offset can be added for easier reading of small values.

R.I. No. 104

ERRATA

Incorrect information on the Mobiletronics Pocketphone was published in ETI, August 1987. The correct data is:

Weight	**530g**
Output Power	**0.6 W**
Sensitivity	**−116dBm**
Model	**PC105A**



Imperial College AGV

Thinking For Themselves

A new generation of free-ranging Automatic Guided Vehicles (AGV) under the development of Dr Colin Besant and his team at Imperial College, London, are beginning to think for themselves.

They use their own 'brain power' to find their way around the factory floor instead of working on the costly 'buried wire' principle whereby the vehicle follows an electrical signal given out by a wire buried in the floor.

The AGVs are given an initial instruction by a supervisory computer such as 'go from A to E via B in 30 seconds', then use their own 'intelligence' to work out ways of doing so.

The Imperial system contains four basic elements: the supervisory computer, primary and secondary guidance systems and the on-board computer. The supervisory computer holds a map of the factory in its 'brain' showing all the available routes, then chooses the best for each vehicle. The primary guidance system is the odometer which counts wheel revolutions on the vehicle to pinpoint its exact position on the route.

The secondary systems monitor the primary one and can tell the AGV when it is off-course or is faced with an obstruction, and take corrective action. The on-board computer receives and acts on modifications signals from the secondary guidance systems.

The system also includes an overhead TV that tracks the vehicle via an infrared beam and relays back information. On reaching its destination a low-power light beam from the docking bay is picked up by a sensitive on-board detector to 'lock' the vehicle in its docking position.

Finally as a safety factor, an ultrasonic device can sense the presence of a person five metres distant and an emergency brake is triggered immediately should anything touch the rubber bumpers on the vehicle.

Dr Besant says the aim is to build whole fleets of Imperial AGVs that will work together with a self-adjusting system, so that if one vehicle fails or another is added, the system instantly reschedules itself.

R.I. No. 105

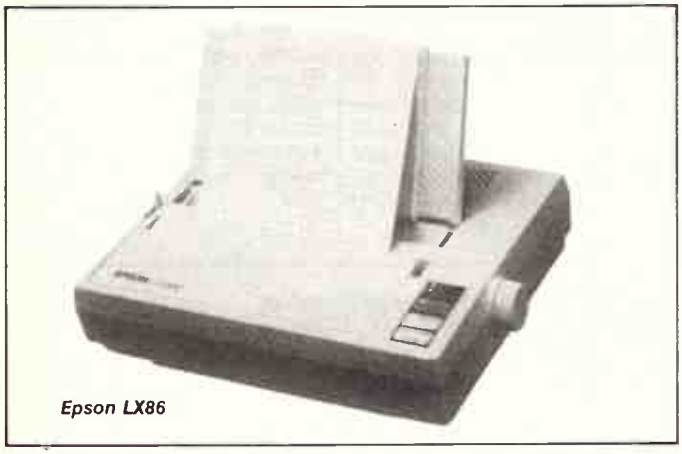
Electrolytic Capacitor For SMPS Applications

A new member of RIFA's PEG124 capacitor family has been developed to meet the demands in high ripple current pulse and filtering applications, ie; switch mode power supplies (SMPS).

This new PEG124SMPS capacitor is available in the range 22 uf to 4700 uF, suitable for applications from 4 Vdc to 16 Vdc. Temperature range −40°C to +125°C. The aim is to achieve low and stable ESR values at frequencies above 2 kHz and good ripple current handling capability within the frequency range used in modern switched mode equipment. A single PEG124SMPS is designed to replace up too three conventional capacitors in this type of application.

As an example a PEG124-SMPS, 1500 uF, 16 Vdc, case size 16 x 37 mm is capable of handling 8.9A RMS ripple current at 20 kHz at an ambient temperature of 40°C, the minimum operational life at this working condition is well above 80 khrs.

R.I. No. 106



Epson LX86

Epson's Additional Features

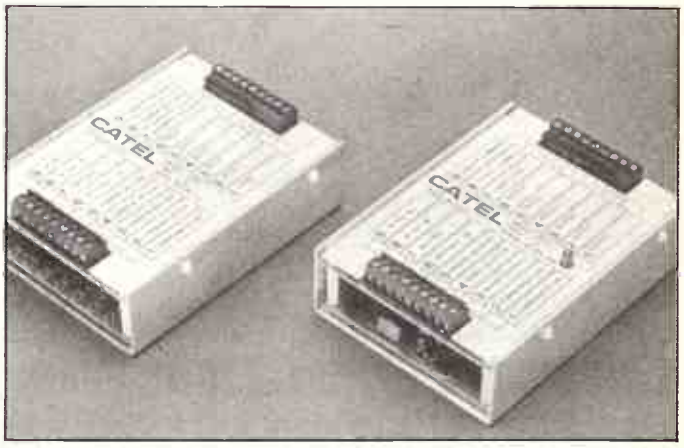
Epson has introduced extra features to the LX-86, a winner of Compass Research's Micro StoreBoard Award 1986, "The Best-Selling Printer of the Year". Called the LX-800, the new printer offers faster printing and throughput speeds.

The LX-800 prints at 180 cps in draft elite and 150 cps in draft pica. The draft mode throughput now runs faster than previous models by 25%. Another feature of this printer is the enlarged 3KB print buffer. The charges have been made by Epson to enable the LX-800 to remain competitive in the printer market.

The SelecType front control panel allows auto single sheet loading. Correct and easy positioning of paper is now guaranteed. In addition to Roman, Sans Serif is now included in resident fonts, and they are easily accessible through the control panel in the near letter quality mode.

One can instantly switch the printer back to the draft mode through the control panel without worrying about complicated DIP switches. The tractor paper feed unit is already built-in with the single bin cut sheet feeder available as an option. The new ribbon cartridge prints 3 million characters, three times more than before.

R.I. No. 107



Catel MS300 multiplex remote

New Module

The new Catel MS-300 series of multiplex remote control and signaling modues transmit digital or contact closure signals over twisted pair coax fibre optics, dedicated phone circuits, microwave or IR. Just released by Sam Technology, the MS-300 modules are ideal for extending control lines, providing remote signalling and alarm inputs and sending data gathered remotely to a central monitoring system.

The modules interface to Catel broadband FM equipment and up to six data points can be handled by each MS-300 transmitter or receiver.

Transmitters and receivers are available in four different bands (2800, 1650, 980 and 580 Hz) so that up to 24 data points can be transmitted in FDM format over one voice circuit.

The easy-to-install modules need an external supply — 16 volt AC as standard, with modifications for other options.

The compact MS-300 modules measures 96 mm wide by 127 mm deep x 45 mm high.

R.I. No. 108

Scanner Adds Graphics

Compuscan has added graphics reading capabilities to its PCS optical character reader. The new Compuscan Personal Computer Scanner (PCS) 240 attaches to an IBM XT, AT or compatible and enters information in seconds. Modules are available to allow interfacing with most other PCs including Wang, Burroughs, NEC and Digital.

The PCS 240 digitises information from logos, line artwork, illustrations, etc, as well as text from pages of reports and correspondence at the rate of 30 seconds per A4 page. Distributed by DBE Australia, the Compuscan 240 looks similar to a facsimile machine and can in fact be interfaced with most faxs.

As a result the computer operator can input material directly to the screen from a remote fax machine via the Compuscan. A simple two button operation is all that is required for entry of documents to be scanned.

R.I. No. 109

Crusading Success

I.T.T. Semiconductors — the largest manufacturer of semiconductors in Germany and the largest diode manufacturer in the world, has appointed Crusader Electronic Components, Australian and New Zealand Distributor for its range of proucts including chips and S.M.D. (surface mounted devices).

R.I. No. 110

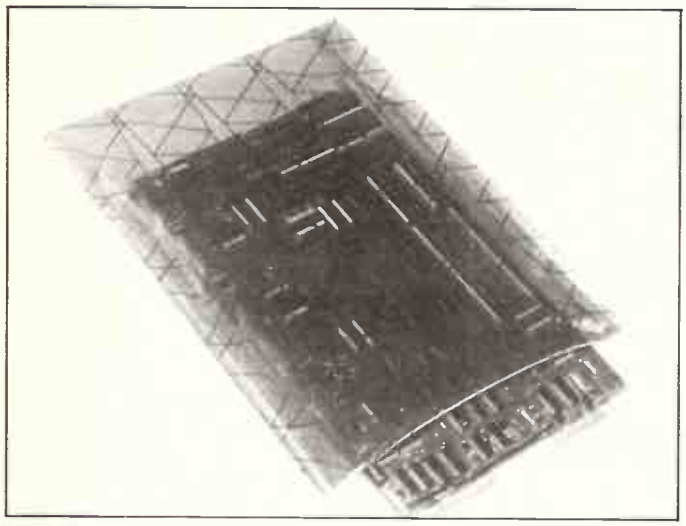
Electronic Tyre Gauge

NSD is distributing what is claimed to be the world's first all electronic (solid state) tyre pressure measuring gauge. Manufactured by Sensym, the microprocessor controlled tyre gauge can be custom labelled for large orders.

No thicker than a common writing pen and including a pocket clip, the Electronic Tyre Pressure Gauge provides precise pressure measurement from 1 PSI to 27 PSI via a digital LCD read-out. The gauge operates from standard 1.5 V batteries.

NSD Product Manager, Bill Scott, said the Sensym electronic tyre pressure gauge would "revolutionise the mechanical portable tyre gauge market in this country."

R.I. No. 137



Static Bags

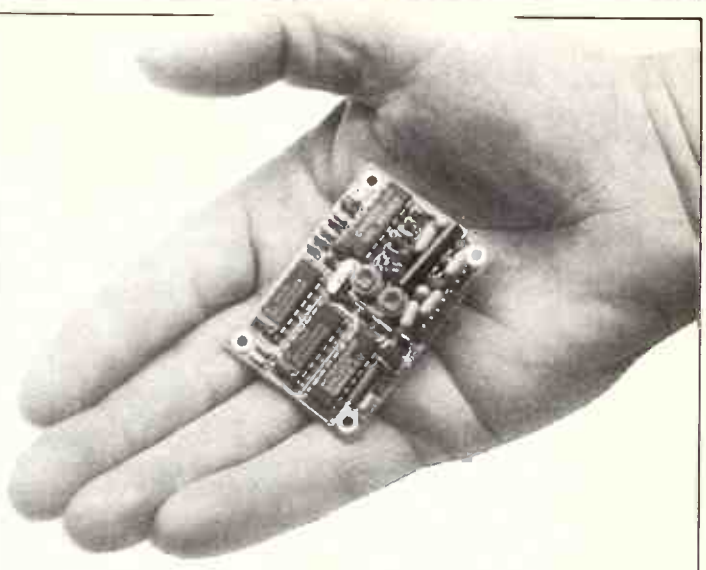
Electrostatic discharge (ESD) can play havoc with sensitive electronic components during handling, warehousing and distribution.

However, a range of metallized static-shielding bags, released this month by Rheem Protective Packaging Products, is claimed to provide complete protection against ESD, ensuring a safe, static-free environment.

Rheem claims that products shipped in Gridstat 9900 bags can be used immediately, without fear of static-induced damage.

Gridstat 9900 bags contain a high performance, conductive grid and a metallized layer sandwiched between sheets of durable, antistatic plastic. During rough handling or shipping, their durable construction provides superior static protection.

R.I. No. 138



Duplex Mini Scrambler

The GSA 1000 mini scrambler is designed for applications where speech privacy is required, but cost and space are at a premium. The GSA 1000 is crystal controlled which Duplex say ensures superior audio quality and long term stability.

Features of the GSA 1000 include easy installation, low current consumption, full Duplex operation, eight secure code keys, AGC control and full installation and technical details supplied with each unit.

R.I. No. 139

High Performance Modem Module

Texas Instruments has announced the release of a high performance multi-standard modem module.

The MOD3110 complies with CCITT, V2bis, V22, V21 and V23 standards as well as the North American Transmission standards; Bell 212A, 103, and 202. The module also includes the modulator/-demodulator and controller functions for automatic call and answer protocols with either V25bis or the Hayes AT command set.

The implementation of these standards allows the end user to access all videotext services and public databases from 300 bit/sec to 2400 bit/sec in full duplex operation. Due to the highly integrated features of the MOD3110, an OEM can easily and quickly design a complete modem with minimal software and hardware effort. The MOD3110, incorporates the necessary interfaces for either a PC-based or standalone mounting and is said to be well suited to a variety of applications such as Personal and Professional computers, workstations, point of sale and videotext terminals. To facilitate market integration two versions of the protocol handler software have been developed. The first complies with the CCITT V25 bis recommendation, and the second one with the defacto standard for PC modems, the AT command set (HAYES protocol).

To ensure establishment of proper communication, the MOD3110 features tone recognition and identification software with built-in diagnostics for condition of connection failure. The MOD3110 is offered in a 50 mm x 79 mm, 50 pin Dual in Line module package.

R.I. No. 140

DEFINITELY NOT YOUR AVERAGE COMPUTER

the Applix 1616 power, price and flexibility

ALL AUSTRALIAN DESIGN, MANUFACTURE AND SUPPORT

"The highest performance computer design ever published"
ETI Magazine December 1986

MOVE UP TO THE 68000

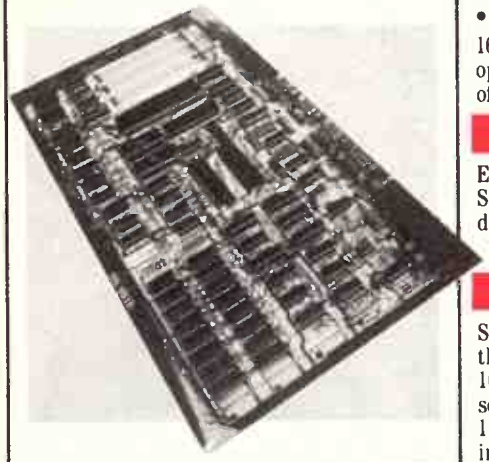
If you take your computing seriously Applix is for you!

The Applix 1616 microcomputer.

The 1616 gives you the power of the Motorola 68000 processor, supported by a hardware design that lends itself to all purposes — industrial control, educational applications or serious programming.

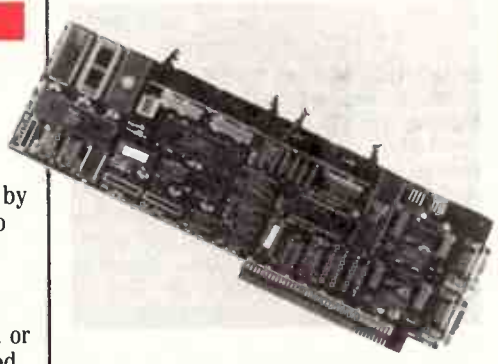
The 1616 is available fully assembled or in "kit" form; the 1616 can be tailored to suit your level of computing needs. Just build up partly for programmable controllers, or all the way for a powerful, flexible personal computer.

After building your system, you have total control using the powerful ROM Resident Operating System, abundant I/O and unlimited expansion capabilities.



POWER AND FUNCTION

- Motorola 68000 (16/32 bit) processor.
- 512K bytes RAM as standard.
- 64K ROM expandable.
- On-board high speed cassette interface.
- Optional disk/co-processor card.
- Four 80 pin expansion slots.
- Dual serial ports.
- Centronics compatible parallel printer port.
- General purpose digital to analogue I/O port.
- Analogue two-button joystick port.
- Graphics: 320H x 200V 16 colours, 640H x 200V any four of 16 colours.
- Standard RGBI interface or composite video.



THE OPERATING SYSTEM

1616/OS offers features such as:

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- File management.
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- 68010 support.
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1616/OS is a very powerful and flexible operating system and takes full advantage of the 1616 hardware.

ASSEMBLY LANGUAGE

Each 1616 kit is supplied with a copy of SSASM — a 68000 macro assembler. Full documentation and system macro library supplied.

32 BIT FORTH

SSFORTH is a complete implementation of the FORTH language. SSFORTH runs under 1616/OS, rather than the normal FORTH screen system. It is fast, has full access to 1616/OS (including EDIT) supports 32 bit integers, float and interrupt driven words. Full source code supplied!

BASIC INTERPRETER

SSBASIC features 32 bit integer numbers, floating point, variables, multi-dimensional arrays and character strings. Access to 1616/OS, graphics and assembler from within BASIC.

APPLIX 1616

"C" COMPILER/CROSS COMPILER

All Australian. The Hi-Tech "C" Compiler running under 1616/OS comes with macro assembler, linker and librarian.

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DISK/CO-PROCESSOR CARD

Truly a computer in its own right, the 1616 Disk Controller Card adds another dimension to the 1616 system.

Using an 8Mhz Z80H as a co-processor, tasks such as getting data to and from the disk can be off-loaded from the 68000, leaving it to do what it does best!

SSDCC Technical Features:

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- WD1772 disk controller chip.
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- Two additional serial ports (under Z80 control) using the Z8530 SCC.
- CP/M support coming!

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READER INFO No. 28

Pulsar's Enhanced Disc Drive

A problem that has irritated users of small IBM computers since the first PC was turned on has been the length of time required to load information from the disc. Now Pulsar in Melbourne has developed a drive that speeds up the process considerably using the new ESDI format.

The problem of disc reading time increases when one tries to run programmes that require lots of information storage, such as data base and computer aided design applications. Indeed, it can actually make the pc useless for some types of programme. In most architectures, the bottleneck in data transfer to a disc is the file server, part of the I/O system. Pulsar have found away around this problem using technology from the mini mainframe market.

The company released a controller card which enables the high speed Enhanced Small Device Interface (ESDI) Winchester type drives used on many mini computers to be connected to personal computers.

Pulsar began development of the controller over 18 months ago when the company became aware of the way in which networks were expanding in the Victorian Education and Health Department areas. Philip Delecretaz speaking at the media launch of the new product, said: "We wanted to be in a position to service these larger LANs in the future, and there just wasn't a product anywhere in the world able to do the job for us. We opened up discussions with the US chip manufacturer AMD about the problem, and they agreed to work with us on the development of a suitable chip. This chip was released on the general market as the AMD 9890, and we began our first production run at the same time."

Pulsar Electronics was established in 1981 as a designer and manufacturer of CP/M based single board computers. One of its first major successes was 'The Little Big Board', which was extensively advertised in ETI at the time.

With the release of the PC, and the rapid market standardization on the MS DOS operating system that followed, Pulsar started to bring out new product, suitable for changing times. The company survived, according to Delacretaz, because of government contracts.

Today, its product includes modems and a range of STD bus expansion and function cards. After the development of on-board modems for specific functions it continued the development of standalone modems adding increasing functionality. The Pulsar SAM modem released last year is the only one of its type approved by both the Victorian and Queensland Education departments. More than 3000 units of this modem have now been sold.

In the second half of last year the company developed three other new products including the Pulsar 7000 Copy-all universal disk format copier, a Tape-to-Optical-Disk archival file storage station capable of storing up to 200 Gigabytes to data, and developed new technology for the design of what is believed to be the world's slimmest keyboard for the IBM range.

The use of ESDI drives with personal computers can eliminate many of the problems and restrictions on large Local Area Networks (LANs). It enables PC's for the first time to carry and service data base files as large as a Gigabyte under the MS-DOS operating system without the need for special drivers.

The rate of data transfer to and from disk in the file server is one of the most inhibiting factors to large LAN performance. An AT 80286 at 10 MHZ can only transfer data to and from a voice coil drive at 250 kilobytes per second. the Pulsar ESDI controller transfers data at just on 1 Megabyte per second — a 400% improvement, complete with software enabling PC users to use ESDI drives in MS-DOS, Novell and Xenix operating systems.

In packaging the product Pulsar have taken a unique approach for system hardware with the design of a see-through blister pack containing the card, cables and screws. The pack can be sold individually for users that have their own drives, or bundled with any manufacturer's ESDI drive.

The card, including Golden Bow disk management software, will retail in Australia for $498 including tax. Pulsar will also be offering the controller with the CAS ESDI 85 Mbyte drive units for $3490 including tax.

— Jon Fairall

Philip Delacretaz, Managing Director of Pulsar Electronics Pty Ltd, with the ESDI Controller card.

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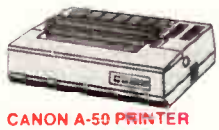

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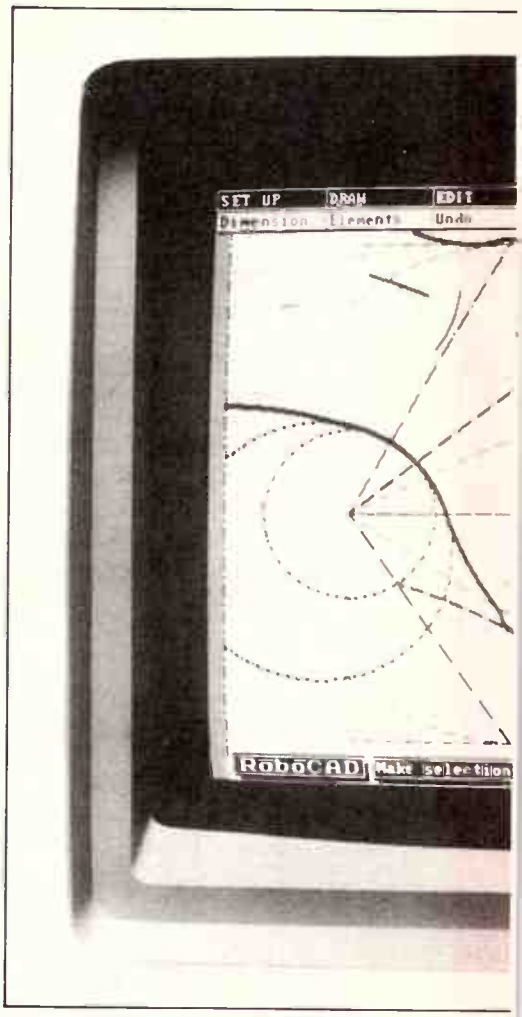
PROCESSORS, FUNCTIONS AND HISTORY

To end this series on microcomputing, Phil Cohen looks at the heart of the machine, the processor, and analyses where it fits in the market.



The first commercial microprocessor was the Intel 4004, which was designed to fit into a calculator. In 1969, a (now defunct) Japanese company called Busicom asked Intel to build a set of 12 chips to be used in a range of calculators. After looking at the problem for a while, Intel decided that it was going to be too difficult, and invented the microprocessor to do the job instead.

The 4004 was released in 1971, and few people thought at the time that they would have any sort of impact other than in replacing 'hard-wired' circuitry — as a direct replacement for a bundle of other chips, rather than as a source of raw computer power. As late as 1978 technical experts were saying the same thing: the microprocessor will not replace the mainframe for computing. Events have proved that to be a little pessimistic.

As its name suggests, the 4004 was a 4-bit microprocessor. This of course is pretty useless for text-based applications such as word processing, or even for use inside terminals, printers, and other text-based devices, because four bits only gives 16 possible values for one 'word', and you need at least six for the alphabet — preferably seven or eight.

The 8008

So Intel released the 8008, an eight-bit microprocessor, in 1972, and later upgraded it to the 8080.

And so it went on. Intel have generally led the microprocessor field, and make the 8086 chip now used in the IBM PC and all of the machines that have copied it, as well as the 80286 which is used in the IBM PC AT, and the 80386 32-bit microprocessor.

There are other companies on the scene, of course. Zilog for a time took over Intel's lead by producing the Z-80 microprocessor, which was 'upward compatible' with the 8080.

Compatibility means simply that the instruction set of one microprocessor contains all of the instructions of another — any software written for that other processor will run on the new one.

The Z-80 performs all of the instructions that the 8080 can perform, and performs them identically to the way the 8080 does. In addition, the Z-80 has a number of instructions that the 8080 does not have. This is called 'upward compatibility', because any software that was written for the 8080 can be moved 'upwards' to a Z-80 machine, while software written for the Z-80 will not work if it is moved 'downwards' to an 8080 machine.

Popular Apples

By providing more power in a processor that would run all of the existing 8080 software, Zilog for a time poached a lot of potential Intel customers, and the Z-80 ruled the roost. During the heyday of the Apple computer its processor, the 6502, was also very popular. The 6502 and its successor the 68000 (used in the Apple Macintosh computer) are generally accepted to be easier to program than the Intel devices.

The operating system that was traditionally used by both the 8080 and of course the Z-80 was called CP/M (short for Control Program for Microprocessors). But when IBM released the IBM PC, it used a new Intel chip called the 8086, which had the virtue of being a 16-bit processor (the Z-80 and 8080 were both eight-bit).

The IBM PC also used a different operating system, called MS-DOS or PC-DOS, and that soon took over from CP/M as the standard for business applications.

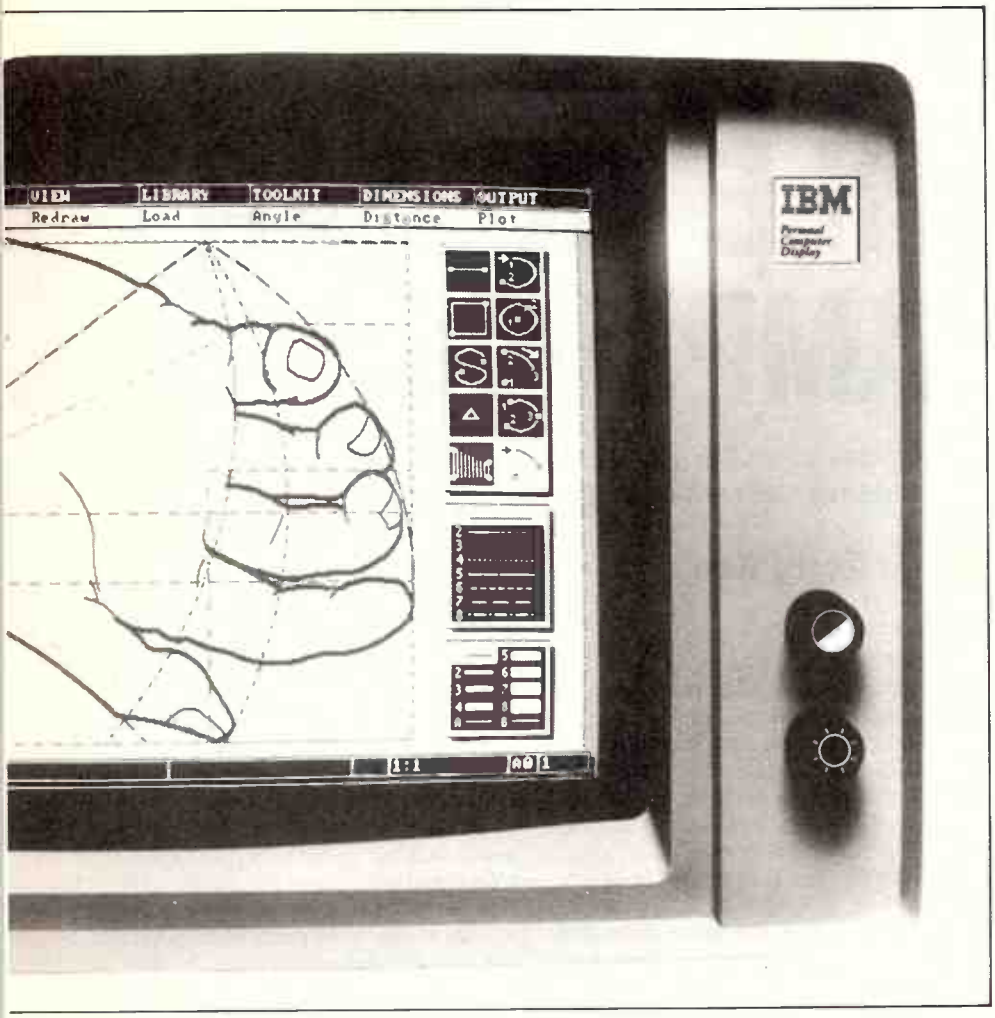
Multitasking

Intel wasted no time in producing what is basically a more powerful version of the 8086, called the 80286. Not only is the 80286 more powerful, it is also capable of running several programs at the same time!

This is called 'multitasking', and works like this: Each of the programs that the processor has to run is called a 'task', and each is allocated a different area of memory. One task can't alter any of the memory locations assigned to another task —this is very important, since if one task goes haywire it will not cause all of the other tasks to do so too.

The processor divides its time equally between all of the tasks which it is running at the time, doing a bit of work on one task, then switching to the next, then the next. Of course, the more tasks there are, the less time gets spent on each one, and the slower they run.

Having multitasking means that you can run a word processor program and at the



same time have another program send a file to your printer. Or you can have a large calculation going as one task, and still use the computer for other things.

The 80286 is upwardly compatible with the 8086, but has one restriction — it cannot run a number of tasks at the same time if they are each written to run on the 8086. However, the newer 80386 can run multiple 8086 tasks, and is a far more powerful device altogether.

The 80386

The first 80386 microcomputer was released late last year, and software written for it can make full use of the 32-bit processor. Intel's next processor will be the 80486, which the company says will be a 64-bit device.

As well as multitasking, the 80386 has a feature that is generally thought of in conjunction only with mainframe computers — virtual memory. This means that although there is, say, 1000 000 bytes (roughly speaking, 1000 K) of RAM memory in the computer, programs can be written that make use of much more memory than that.

Virtually memory works by allocating sections of a disk (normally a hard disk) as 'memory', and then swapping those sections with the contents of RAM. For example, say at the start that the processor is trying to read a byte from location 500 000. No problem: that's a location in RAM and the processor can read it directly. Now say that the processor wants to look at location 1500 000 — the computer automatically stores the contents of its RAM onto disk, then copies the part of the disk which corresponds to RAM locations 1000 000 to 2000 000 into memory, and then lets the processor loose on it again.

Of course, when the processor wants to look at location 500 000 again, the whole process is reversed. Swapping memory to and from disk is a slow process, compared to having the information right there in memory. But if the software is well written, this swapping need not happen very often.

These and a lot of other tricks which were formerly only found in mainframe computers are becoming part of the microprocessor world. In the future, working directly with microprocessors in machine code is sure to become more and more complex — but at the same time, writting software in high-level languages like PROLOG and fourth-generation languages will become easier, as the processor takes on more and more of the work of turning the program into machine code.

In fact, the new operating systems such as the one used on the Apple Macintosh, are making the work of the user and programmer less and less, while at the same time making the processor do more and more work to help the user.

So microcomputers will get easier, and at the same time harder to use. No doubt one day it will be impossible for a human being to device a machine code program, and all of the machine code will be produced by compilers running on powerful computers.

Glossary

CP/M: Control Program for Microprocessors — an early operating system for micros.

Compiler: A program for turning a program written in a high-level language into machine code.

Fifth-generation language (5GL): One in which even the order in which the steps of the program are to be carried out is decided by the computer.

Fourth-generation langauge (4GL): One which allows the use of a database.

Hard-wired: Built using conventional electronics, without microprocessors.

High-level language: A language which is designed for use with a compiler.

Intel: A company that manufactures microprocessors.

MS-DOS: MicroSoft's Disk Operating System — the operating system designed for the IBM PC.

Multitasking: Running more than one program at the same time — each program is called a 'task'.

PC-DOS: Same as MS-DOS.

Task: See Multitasking.

Upward compatible: If a new microprocessor is able to run all of the software that a previous microprocessor could run, then the new one is 'upward compatible' with the old.

Virtual memory: A scheme in which RAM is 'extended' onto a disk, by pretending that each point of the disk is a memory location.

Zilog: A company that manufactures microprocessors. ●

ETI 1424 VERSATILE GUITAR PRE-AMPLIFIER

Guitar players always place over the top demands on their gear. This guitar pre-amp certainly delivers over the top specifications.

Terry Kee

COMMERCIAL GUITAR AMPLIFIERS do not appear to be getting any cheaper so a good low cost alternative is to build your own. Power amplifier modules are commonly available from your local kit suppliers at very reasonable prices with excellent performance, particularly those published in this very magazine.

The ETI-1424 is intended to provide high quality pre-amplification especially tailored for the electric guitar. The equalizer sections are optimised for the frequency range where the guitar needs them most.

The main features of the pre-amp include a top boost and normal input for guitars, two pre-eq line inputs, bass and treble controls, effects send and return, a sweep eq section, four post-eq line inputs and a master level control. No level control is provided for the line inputs as typical inputs would be drum machines and synthesisers that have their own individual volume controls. This set-up is designed for the all too common situation where there are insufficient amplifier inputs for all the instruments. More often than not, this happens in a rehearsal situation.

The bass and treble are designed to provide maximum cut and boost of frequencies at 100 Hz and 8 kHz to obtain a wide tonal range for an electric guitar. To give a harder edge to sounds, a top boost input is available whereby frequencies above 1 kHz are amplified; at around 10 kHz there is a massive 20 dB of boost! The normal input has a flat response and is excellent for those mellow rhythm chords. A bass cut is built into the input amplifiers IC1a and b as in a live set-up, very low frequencies combined with speaker cabinet resonances tend to muddy the overall guitar sounds, not to mention setting off the cymbols at some resonant frequency! The guitar inputs have a fairly high input impedance of 220 k to ensure that the pick-ups are not loaded and thus obtain maximum sustain. Due to the high input impedance hum pick-up can be a problem, so the jack sockets are wired in such a way that any unused inputs are shorted to ground. No casing details will be described here as it is likely that the pre-amp will be built into the box that houses the power amplifier. A metal box is recommended to minimise hum pick-up.

Many of the facilities of the 1424 can be tailored to your requirements. If you decide that you do not want any pre or post eq line inputs, as an example, then it is simply a matter of linking the relevant inputs to ground on the pc board. A similar procedure applies if you do not want an effects send and receive, simply link the effect send out pad to the effect return pad with some hook-up wire.

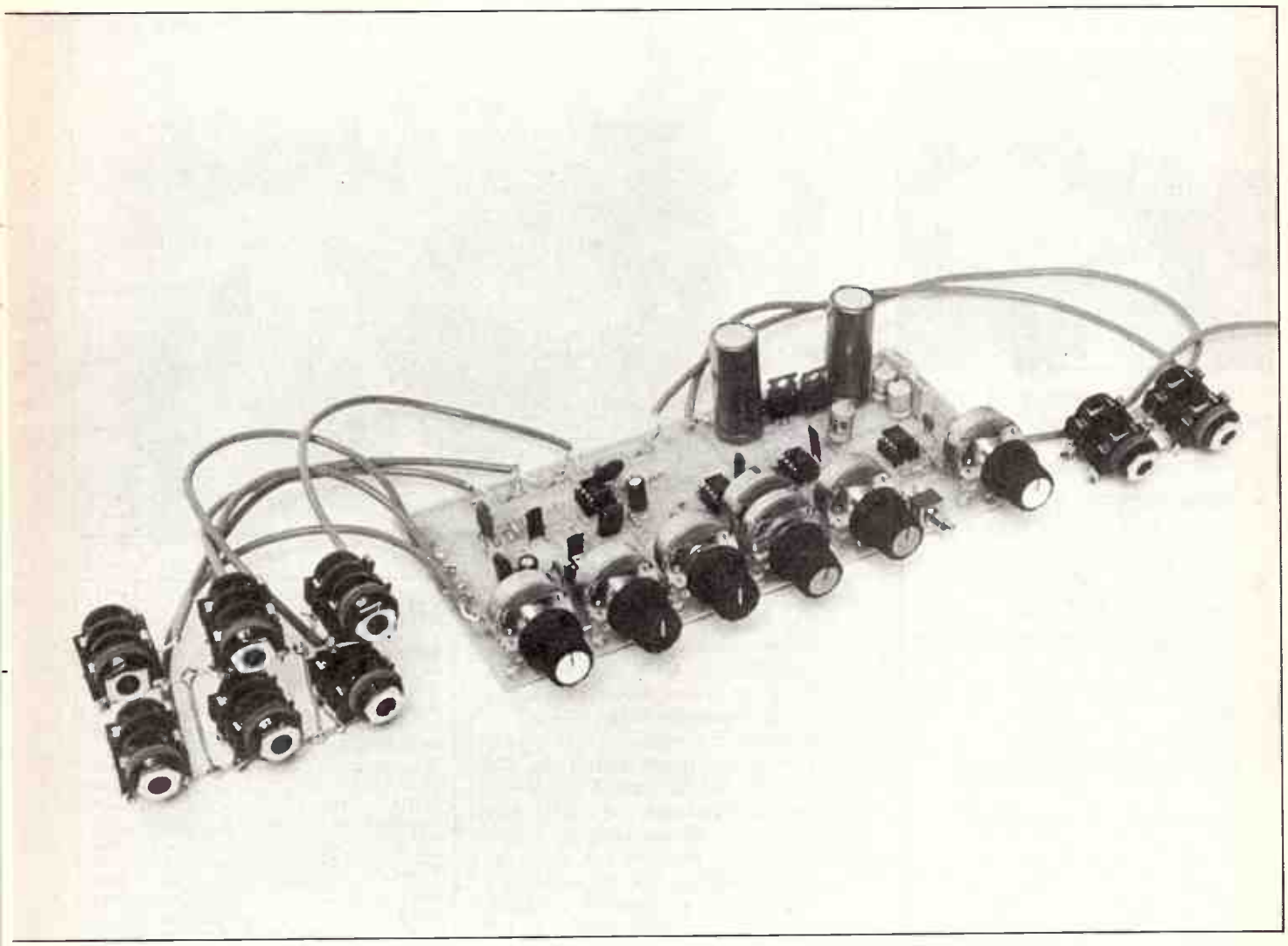
The effects return is fed to a sweep equaliser that has an adjustable frequency and gain control. The circuit is a modified version of the parametric equaliser that appeared in an earlier ETI. A bandpass or bandstop type of response is exhibited with the resonant frequency made adjustable over an extremely wide range of 200 Hz to 8.5 kHz using a single control. The sweep eq supplies a massive 18 dB of boost and −22 dB of cut at the resonant frequency and can be adjusted by the gain control. The Q-factor is fixed and gave good tonal variations with a guitar signal. A bypass switch is included to switch the effect in or out when required. It's useful for pre-setting the eq for that funky toppy rhythm lick! The 1424 derives it's +/− 12 Vdc power from it's on board regulated power supply.

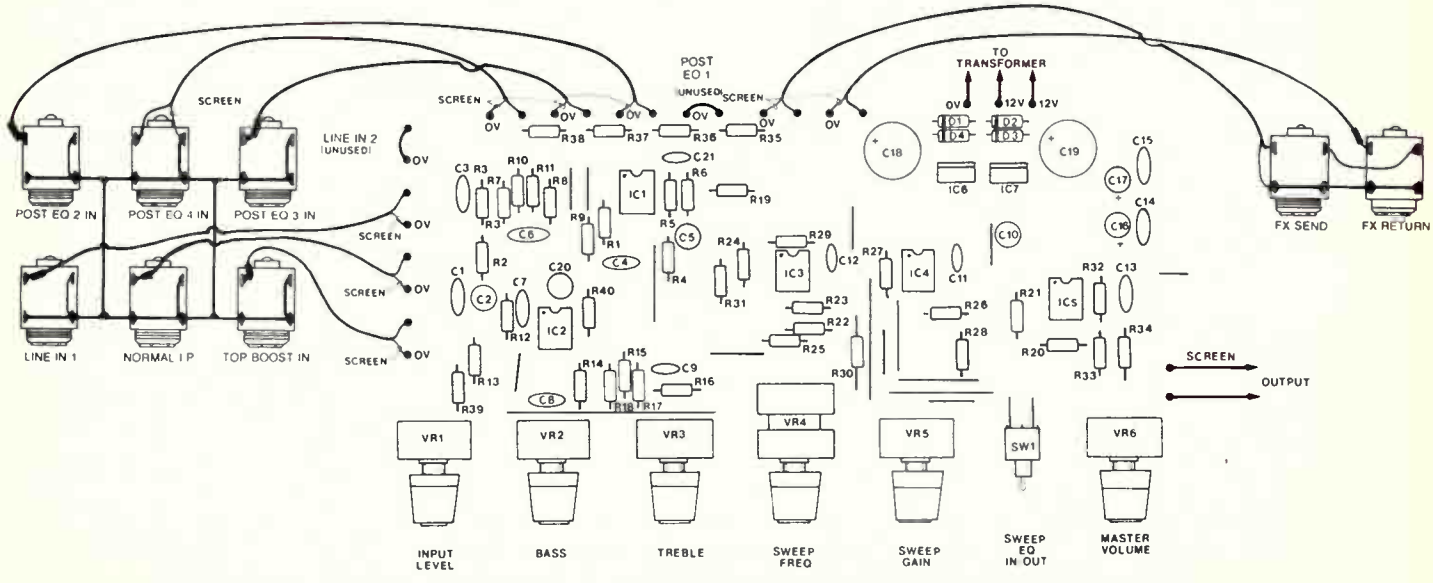
Construction

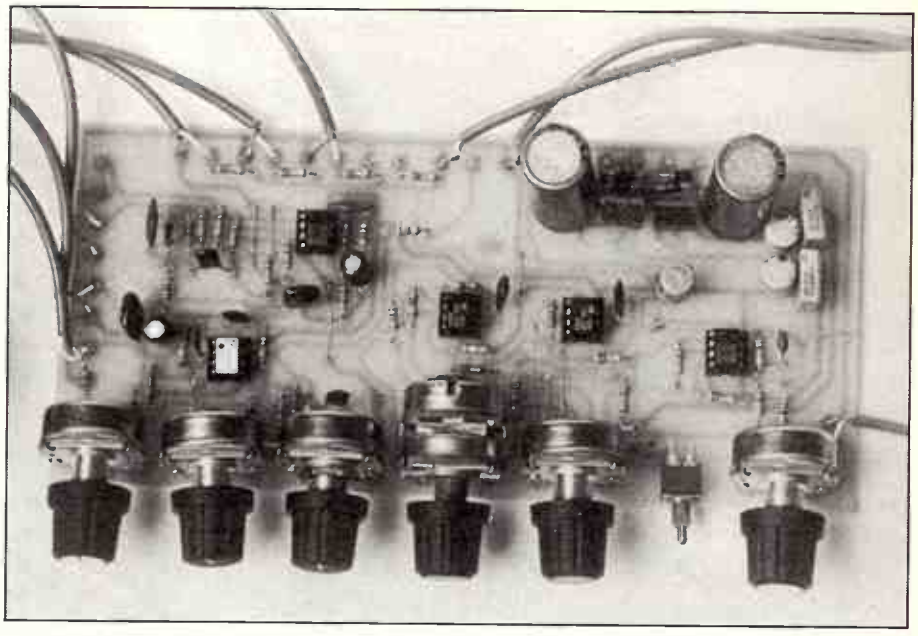
The pc board is designed to be mounted directly to the front panel of the amplifier box and is fastened down via the nuts on the pots. If you do not want to use pc mount pots and pc mount switches then use the shortest length of hook-up wire to make the connections to these components to minimise hum and pick-up. You will also have to drill some mounting holes on the pc board. Make sure that the holes do not break any tracks.

Building up the pc board should not present any problems as the entire circuit is contained on one single-sided board. The first task is to check the board for track breakage and shorts. It's a good idea to go through this process even though you may have obtained the board from a kit supplier. No-one is perfect! Faults will be much easier to spot now than when the board is populated with components. Once you are satisfied it's time to drill the component holes, if it is an undrilled board. Make sure that the holes for the pc mount pots are large enough, a 2 mm drill bit should be adequate.

Construction can start by inserting the links, resistors, capacitors, and ic sockets and soldering them in. Take note of the polarity of the electrolytic caps, refer to







the component overlay. Do not as yet insert the IC's themselves. Insert and solder in the pc mount pots and switch, making sure that they sit firmly and parallel to the pc board. The +/− 12 V regulators (IC6 and 7) are the final components to solder in, note the orientation on the overlay.

Next comes the wiring of the inputs, output, send and return sockets and the mains transformer, if required. After you have decided what inputs you require then it's just a matter of measuring the length of shielded cable to connect to the sockets. Do not forget to link any unused inputs to 0 V on the pc board. It is a good idea to mount the input sockets as far away from the mains transformer as possible to minimise hum pick-up. Also mount the inputs away from the outputs to minimise cross-talk. Use insulated 6.5 mm jack sockets to avoid hum loops. The hot end of the input sockets need to be grounded when no plugs are inserted hence sockets with closed contact are required. The input sockets should have their earth connected together at the sockets with some tinned copper wire. A single connection from the braiding of one of the input screening cable is all that is required to connect the socket earths to the pc board. Refer to the wiring diagram on the overlay. The earth screen of the other inputs needs to be soldered to the 0 V but cut off at the socket end. Make sure that the open ended screen does not short any of the inputs, use some sleeving or insulated tape if you are unsure of your wiring.

The same procedure applies to the effects send and return sockets. Do not forget to link the send out to the return in on

ETI 1424 Parts List

Resistors
All ¼ W Metal film, 5% tolerance

R1,4	220k
R2,6,30,31	2k2
R7,13,40	1k
R8,9,10,11,12,18,20,21,26,28,32,33,35,36,37,38	10k
R3,5,14,15,27	22k
R16,17	4k7
R19,34,39	56R
R22,25	56k
R23	3k9
R24,29	100k
VR1,6	10k log pc mount pot
VR2,3	100k lin pc mount pot
VR4	100k lin pc mount dual-gang pot
VR5	10k lin pc mount pot

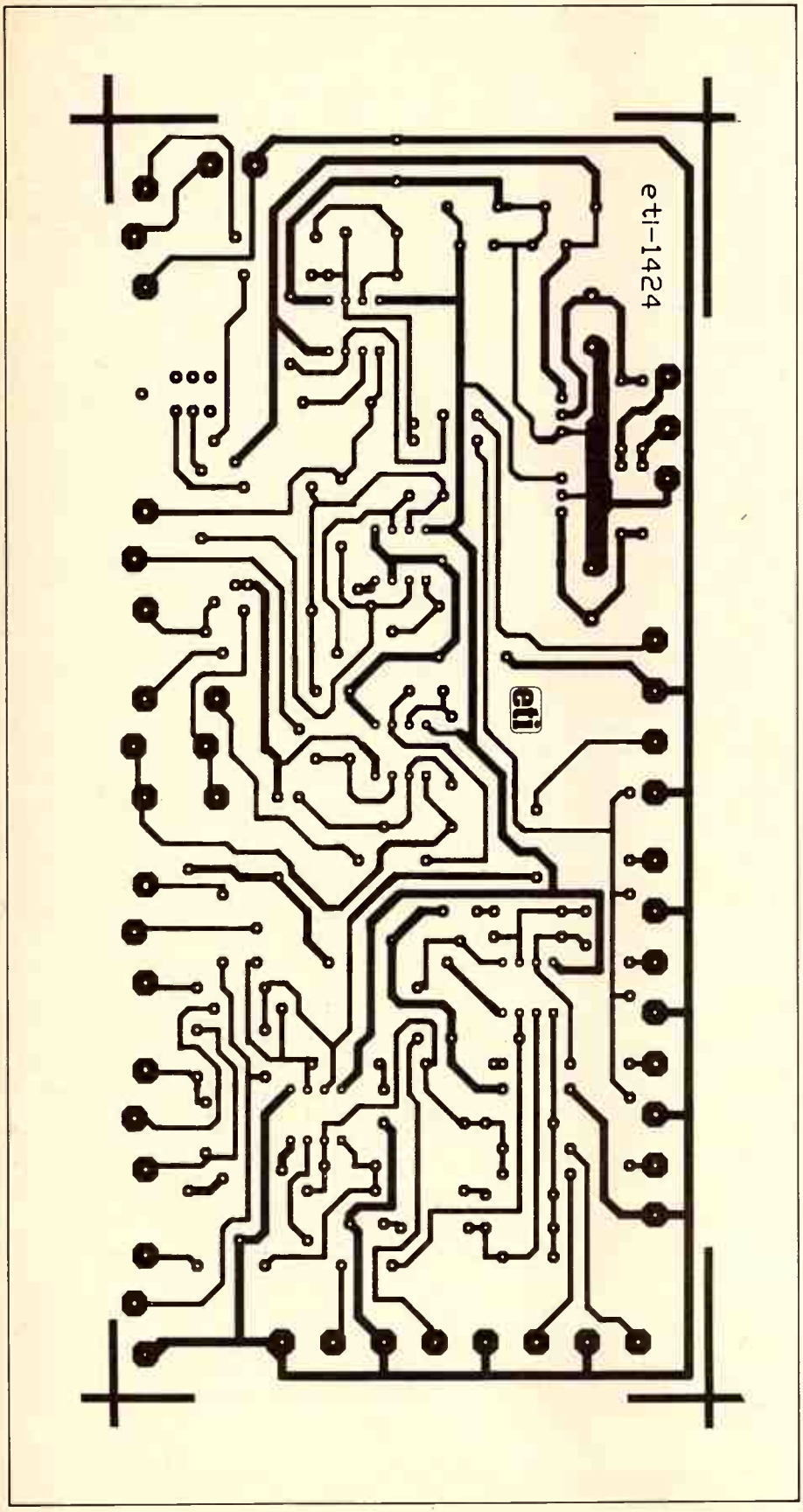
Capacitors

C1,4	56n greencap
C2,5	1u/35V bipolar electro
C3,21	82p ceramic
C6	10n greencap
C7,13	560p ceramic
C8	22n greencap
C9,11,12,20	8n2 greencap
C10	3u3/35V bipolar electro
C14,15	100n greencap
C16,17	33u/35V axial electro
C18,19	1000u/35V axial electro

Semiconductors

IC1,2,3,4,5	TL072
IC6	7812
IC7	7912
D1,2,3,4	1N4001

Miscellaneous
SK1 to 11 .. 6.5mm Mono Insulated Jack Sockets (contacts closed when plug is not inserted)
SW1 ..... PC Mount Miniature DPDT toggle
T1 ..... 12V-0-12V at 500 mA Mains Transformer
Shielded Audio Cable
5 off 8 pin dil IC sockets



the pc board, if you are not using this facility. These sockets are wired in such a way that the signal path is broken when a plug is inserted otherwise continuity is made, refer to the wiring diagram. Use a length of screened cable to connect the output of the pre-amp to the power amplifier.

The mains transformer for your power amplifier may have 12V-0-12 Vac tappings that can power the 1424 directly, otherwise a separate transformer will be required. Ensure that you use mains cable for all connections that carry mains voltage and that the metal chassis of the box is securely earthed. Be extra careful with any mains wiring.

Testing

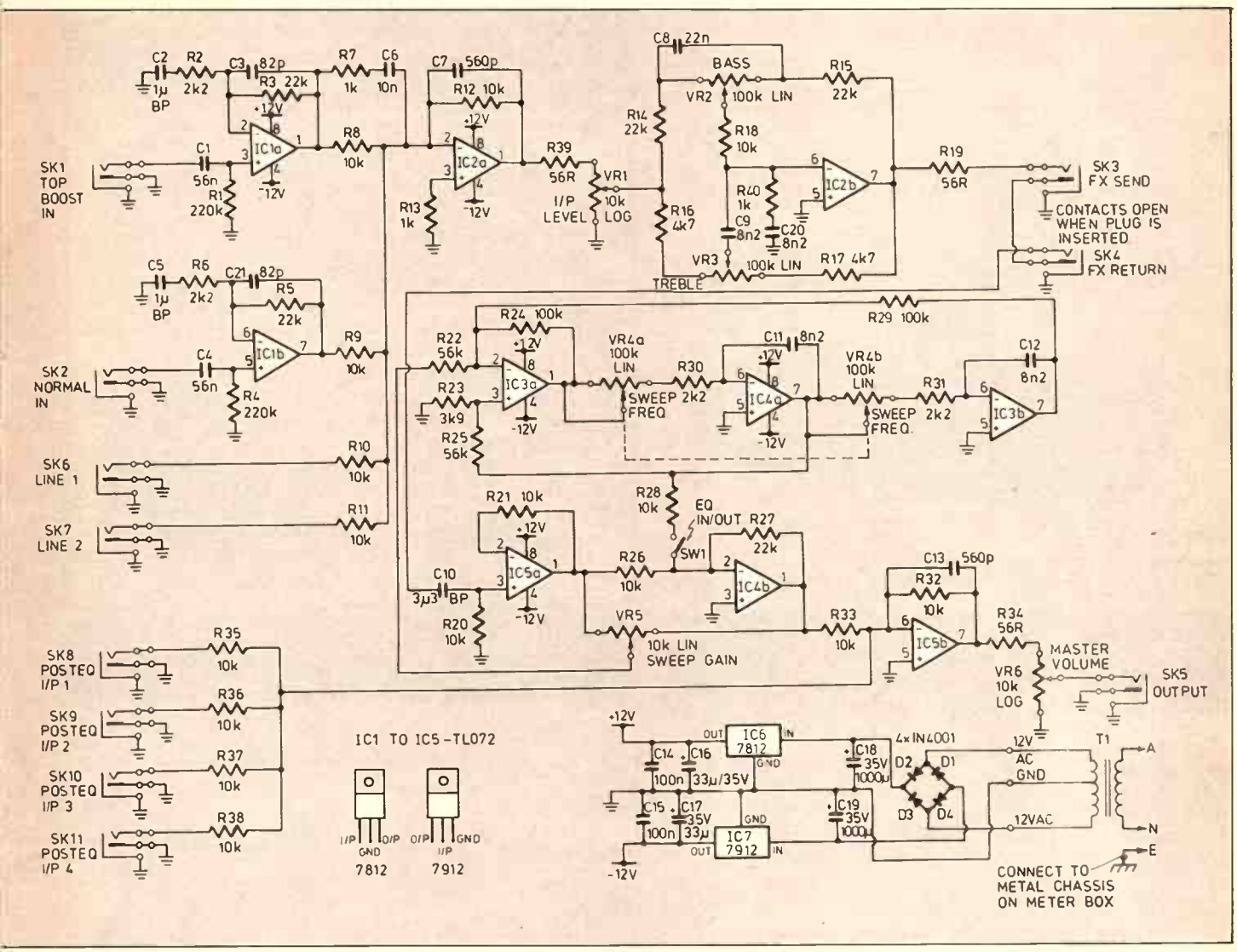
Once you are satisifed that the pc board is free of solder splashes and dry joints, then it's time to fire up the circuit. Without any of the ic's inserted, apply the power and check that there are +12 Vdc at pins eight and −12 V at pins 4 of the IC's. When it has been established, switch off the supply and insert the IC's. Make sure that they are orientated the correct way, refer to the overlay. Power up again and re-check the dc rails. It would be a good idea to disconnect the output to the power amp for this test. Set the bass and treble knob to midway and the sweep eq to out. Plug in a guitar and check that each input produces an output signal at the output of the pre-amp. Twiddle the tone controls individually and you should hear the difference! Switch in the sweep eq and turn the gain control clockwise to give a boost. Twiddle the frequency knob and you should hear the peak being swept over the frequency range. ●

ETI 1424 How it works

IC1a and b are connected as non-inverting amplifiers with a 20 dB fixed gain set by R2, R3 and R5, R6 for each input amplifier. The sensitivity of these amplifiers can be altered quite easily to suit the different levels of various pick-ups and to match the input sensitivity of different power amplifiers. The voltage gain equation is given by Av1a=1+R3/R2 and Av1b=1+R5/R6, hence to reduce the gain R3 and R5 need to be reduced. These amplifiers are ac coupled via C1 and C4 and the input impedance is set to 220 k for both the normal and top boost guitar input. The output of IC1a is fed to an equalizer network consisting of R7, R8 and C6 that boosts signal frequencies above about 1 KHz and will have a massive 20 dB boost at 10 kHz. The outputs of IC1a and b are mixed in IC2a which is connected as a adder, the two pre-eq line inputs are also summed at this point via R10 and R11. The level can be adjusted via VR1 before it is fed to the bass and treble tone controls built around IC2b. It is an active tone filter with the frequency selective components in the feedback path of IC2b. The bass control has a +/− 12 dB of cut and boost at 100 Hz and the treble control has a +/− 20 dB at 8 kHz. With the tone controls set to midway a flat response within 3 dB can be expected. R40 and C20 provides attenuation at high frequency for stability. The output of IC2b is buffered by a 56R resistor R19 to aid stability when driving capacitive loads.

The effects return is ac coupled via C10 and is buffered by IC5a and provides an input impedance of 10 k set by R20. The sweep eq is based on a standard active state variable filter, built around IC3a, 3b, 4a and b. The centre frequency is determined by VR4a and b, R30, R31 and the capacitors C11 and C12. An extremely wide frequency range of 200 Hz to 8.5 kHz can be obtained using a single pot control, VR4. The Q-factor is set to 4 by R25 and R22 and VR5 allows a variation over the stated frequency range. SW1 allows the sweep eq to be bypassed with an overall unity signal level except at the boost or cut frequency. The eq output is then mixed with the four post-eq line inputs in the summer, IC5b, VR6 controls the main output level of the pre-amp.

The 12 V-0-12 Vac is rectified by D1 to D4 which are connected as a full wave rectifier and smoothed by capacitors C18 and C19. A regulated +/−12 Vdc supply is derived from the 7812, (IC6) and 7912, (IC7) regulators. The circuit draws a dc current of around +/− 21 mA.



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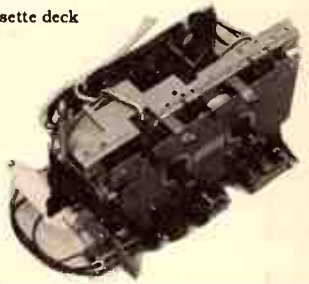

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- PCB artwork from the magazine is the biggest problem. It is very often late, and occasionally incorrect.
- Specialist components is a big problem. We order such parts the moment we receive parts lists, and are often quoted 12-14 weeks delivery.
- General poor availability of components, as most are imported.

We are not just making excuses, we would dearly love to have all new kits on the shelf when the magazine article appears, but sometimes it is not possible. We suggest you give us a ring first and check availability on new kits before you visit.

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Ref: Silicon Chip (New Magazine) Nov '87
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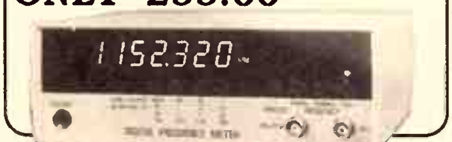

OFF HOOK INDICATOR FOR PHONE
Ref: Silicon Chip Nov 1987
If you have two or more telephones on the one line, with this project a LED will flash on the phones not used to indicate the line is in use. One kit is needed for each telephone.
PC board and components supplied. (Unit mounts in telephone).
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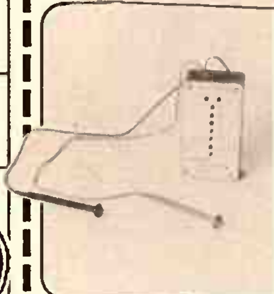

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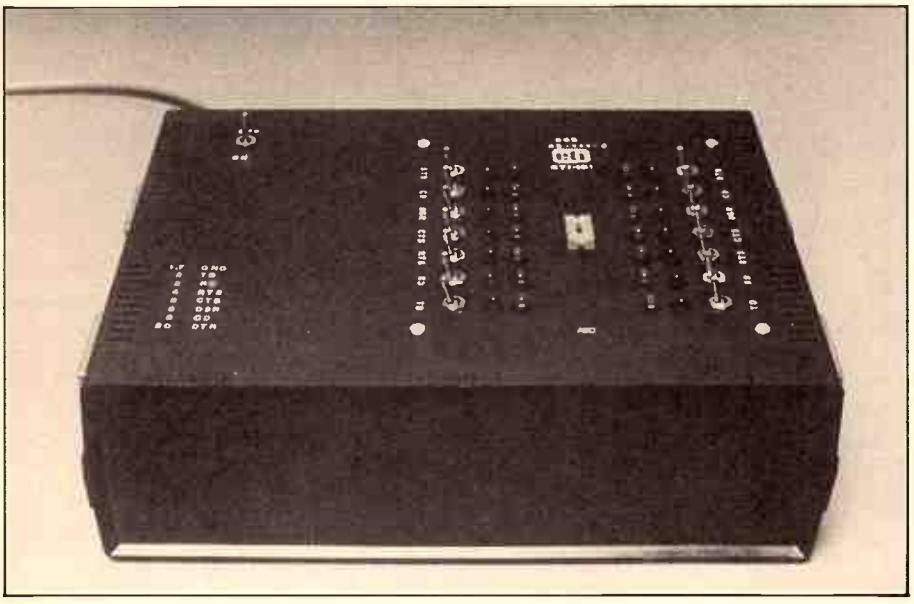
ETI 181: RS 232 BREAKOUT BOX

The BreakOut Box (BOB) is one of the fundamental pieces of test equipment for testing RS232 ports. This is a simple but flexible version of the idea.

This project was developed by the staff of All Electronic Components, Lonsdale St, Melbourne.



THE RS-232-C STANDARD greatly simplifies the interconnection of digital devices. When something goes wrong at an RS-232-C interface, the 25 signal lines and two equipment configurations — Data Terminal Equipment (DTE) and Data-circuit Terminating Equipment (DCE) — can easily confuse the trouble shooter. The RS-232-C BreakOut Box (BOB) is a piece of test equipment used to simplify RS-232-C trouble shooting.

BreakOut Boxes can be simple or very complex. In its simplest form a BreakOut Box displays the polarity of the voltage on an RS-232-C line. Fortunately, many of the problems generally encountered can be diagnosed with a relatively simple BreakOut Box.

Average BOB

This project describes the construction and use of BOB, an "average" BreakOut Box. It features:

— A male and female DB-25 connector at each end of the unit,
— A patch bay that any of the 7 most important lines at one end allow to be patched to any of the same lines at the other end,
— The ability to st any lines to +12 V or −12 V, and
— Two coloured LED's to indicate the polarity of the voltage on each line.

The circuit is simple. Each of the signal lines (2, 3, 4, 5, 6, 8, and 20) are taken from the DB-25 connectors to the DIP socket in the centre of the BOB. The DIP socket acts as a patch bay. Any line from one pair of connectors can be patched to any line on the other pair. Each line is attached to a SPDT Centre-off Toggle switch. One position of the switch sets the line to +12 V; the other position sets the line to −12 V. The centre position lets the line float at the voltage applied to it by the devices attached to the BOB. Polarity indicating LED's with current limiting resistors display the polarity of each line.

A ±12 V power supply is built in to this project, so that if set voltage levels ±12 V are required on RS-232-C lines, they are provided.

Construction

Begin construction by inserting all links on the pc board, follow with the resistors, and then the PC Stakes. DO NOT at this stage insert the LED's or Switches.

Mark off the four holes from the front panel and printed circuit board, making sure that they are aligned. The front panel is located in the centre of the case — leave a few millimetres clearance from the vents in the top of the case.

Now drill the holes for the switches and LED clips (6.2 mm), and cut out the rectangular section for the DIP Socket. Clip in the LED clips and insert the LED's, making sure the polarity is correct.

The switches may now be mounted, ensuring that they are all at the same height. At this stage the wires to the pc board should be connected, leaving enough length to allow them to go to the DB25 connector and power supply. Next, cut holes for the DB25's on the sides of the top half of the case, fit the DB25 and connect the wires from the pc board. One male and one female DB25 are wired in parallel. Watch the pin numbers.

Place the four ½" spacers between the pc board and lid, and at the same time, guide the LED leads, DIP Socket, and switches through the pc board. Insert the four bolts through the front panel, case, spacers and pc board and tighten with nuts supplied. Finally, solder the DIP Socket, LED's and switches on the back of the pc board.

The power supply is straight-forward. Assemble all the components on the pc board, and place the transformer on the left-hand-side base of the case. Bring in the mains cable through the back panel and keep it close to the bottom of the

case. Connect active and neutral wires to the transformer, and the earth wire to the case of the transformer.

Now place the power supply board next to the transformer, using 10 mm spacers to keep it clear of the case. Connect the secondary of the transformer to the appropriate terminals. Now the power rails from BOB may be connected to the power supply.

BOB is now ready for use.

Potential problems:

Before using BOB, you should understand two circuit shortcomings. Firstly, BOB draws current from the circuit under test, and secondly, unless care is taken BOB can create short circuits.

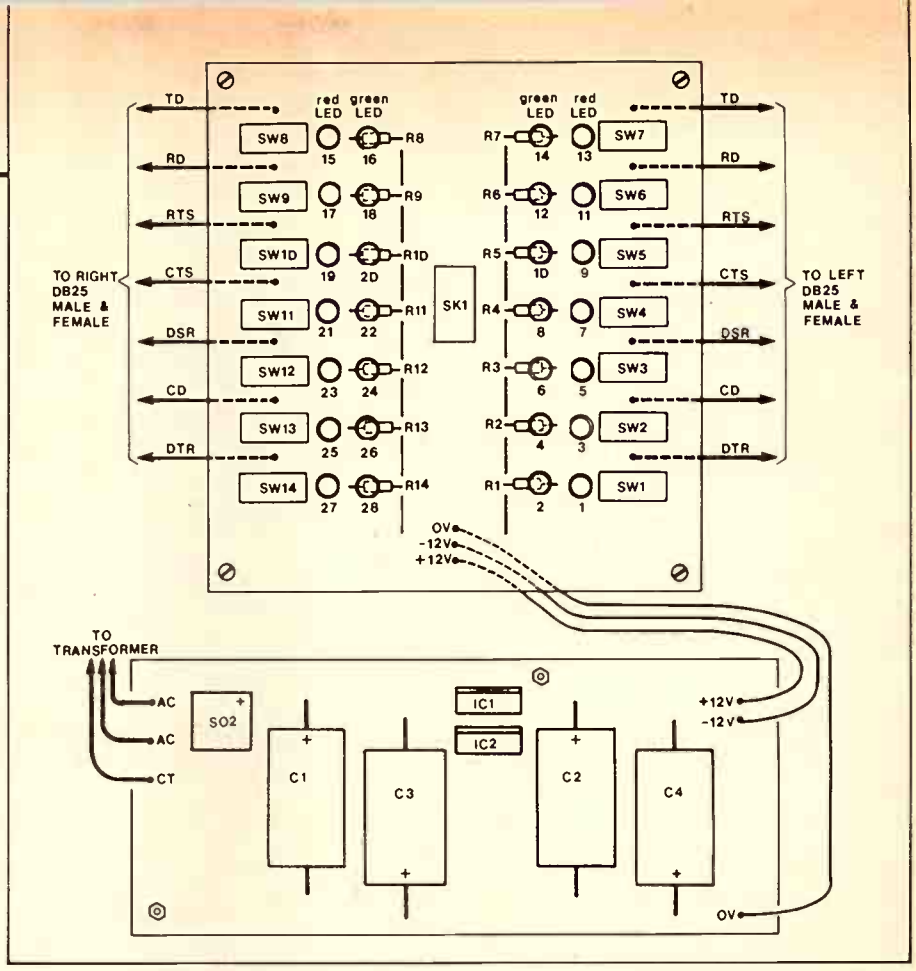
BOB draws current from the circuit under test to light the polarity indicating LED's. By using current from the circuit being monitored, the need for active buffers and transistor switches is eliminated. However, it means that BOB loads the RS-232-C device connected to it, and in extreme cases, this loading may interfere with circuit testing. If this is suspected, use an oscilloscope to check circuit voltages. If positive voltages are much below 12 V, or negative voltages are much above −12 V, the circuit is overloaded.

It is possible to switch a line to +12 V on one side of the patch bay, patch it across to the other side, and then switch it to −12 volt. This will short-circuit the power supply. It is also possible to cause a short-circuit if an attempt is made to set a line that the equipment under test is setting. This is even more serious, since it might damage the equipment. However, if care is taken, you will encounter no problems with BOB.

Using the Break-Out Box:

To begin, make yourself familiar with the names of the various lines, as this will give you an insight to these functions.

It is also valuable to know which type of device, DCE or DTE, generates each signal. When you are familiar with the RS-232-C interface, and familiar enough with BOB to understand its limitations, you will be able to begin using it. It is impossible to anticipate every configuration of BOB that will be useful; however, descriptions of a few common problems and how BOB is used to solve them can help you learn.



Activating DCE:

It is often necessary to test a modem or other piece of data-circuit-terminating equipment (DCE) without having it attached to a computer.

To activate a DCE, lines 20 and 4 must be set to +12 V. To do this, use BOB with no jumpers in the patch bay. Set all of BOB's switches in the centre (off) position. Connect the DCE to one of BOB's DB25 connectors, and set the switches for pins 4 and 20 to the +12 V position. Be sure to use the switches on the same side of the patch bay of the DB25 that you are using. Now, assuming that the DCE is a modem, you should see a carrier at its analogue output. By setting the switch for line 2 (TD) to +12 V it should be possible to change the tone coming from the modem.

LED's should indicate that the modem is setting pins 5 and 6 to +12 V. These lines are used to activate equipment attached to the modem. If they are inactive, or remain at −12 V, then the device attached to the modem might never send any data. If the modem does not respond correctly, then it is not operating as a standard DCE device. Further troubleshooting is in order. If the modem does not respond as predicted, you know that any problems you have are caused by some other piece of equipment.

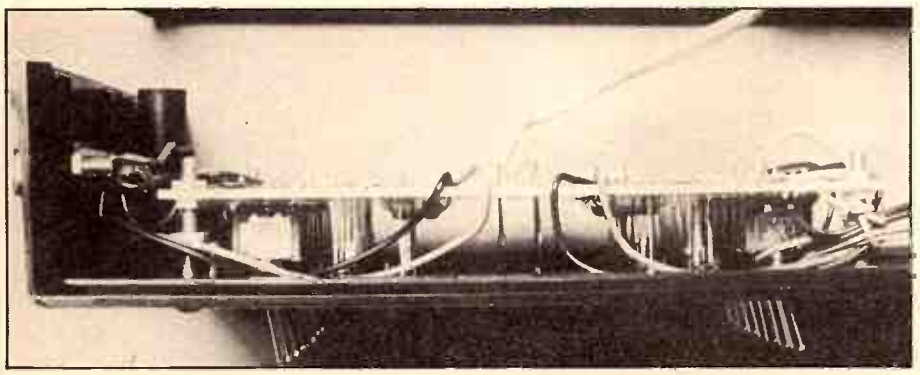
Activating DTE:

BOB can also be used to activate a Data Terminal Equipment device (DTE), such as a terminal, to see if it is operating correctly.

With CTS, DSR and CD switched to

RS232-C Connections:

PIN	1	Protective Ground
PIN	2	Transmit DATA (TD)
PIN	3	Received DATA (RD)
PIN	4	Request to send (RTS)
PIN	5	Clear to send (CTS)
PIN	6	DATA set Ready (DSR)
PIN	7	Signal Ground
PIN	8	Received line Signal Detector (CD)
PIN	20	DATA Terminal Ready (DTR)



+12 V, data sent by the DTE should appear as a flickering of the LED on line 2 (TD). If the data does appear, there are still some things you should use BOB to determine: e.g: does the DTE set line 20 (DTR) to +12 V? (many DCE devices must have this line set to +12 V); does the DTE under test, set line 4 (RTS) to +12 V before sending data?; how does the DTE react to changes on lines 5 (CTS), 6 (DSR) and 8 (CD)?

These questions can be answered quickly by changing switches and observing the LED's. The answers will come in handy when you wish to interface the DTE to another piece of equipment.

Connecting like devices:

It is sometimes necessary to connect two RS-232-C devices with the same configuration (DCE or DTE). If two terminals (DTE) are simply wired together, they would both attempt to transmit on line 2, and receive on line 3.

This means that the transmitted signals would collide, and no received signals would be heard. Both units would also be setting line 4 to +12 V, but lines 5, 6, and 8 would be set by neither. This would not work because there is no difference in potential.

By using BOB, two DTE devices can be connected without any problems. In this configuration, BOB is called a "null modem" since it replaces the modem's that would usually connect two terminals. Two DCE devices can be connected in a similar manner.

ETI 181 PARTS LIST

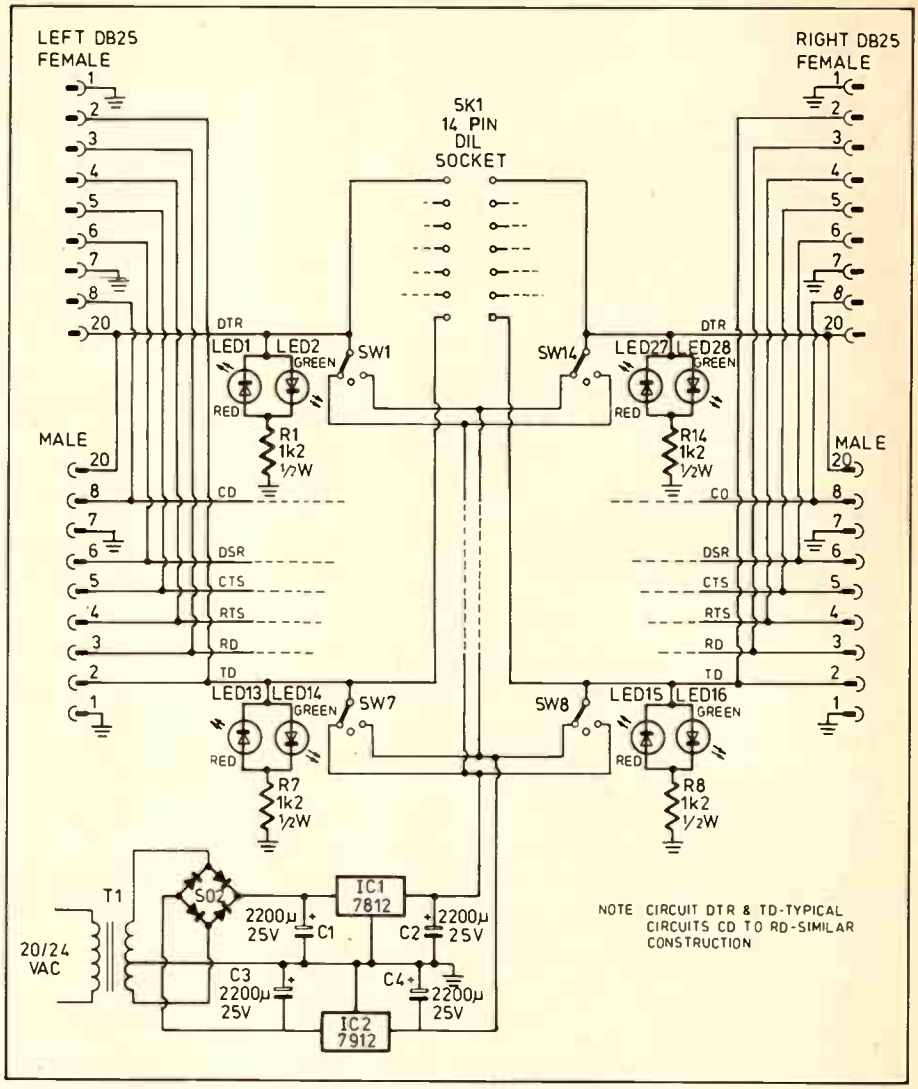
1 only Printed Circuit Board, 86-9-2
14 only SPDT Centre-off Toggle Switches
14 only Red 5 mm LED's
14 only Green 5 mm LED's
28 only LED clips
14 only 1K2 ½ watt Resistors
1 only 14 pin Wire-wrap I/C Socket
1 only Silk-screened, Aluminium, Front Panel
1 only Large Plastic Case
4 only ½" Plastic Spacers
4 only 1 x ⅛" Bolts
1 metre Tinned Copper Wire
2 only DB25 Male Connectors
2 only DB25 Female Connectors
14 only ½" x ⅛" Bolts
18 only ⅛" nuts

POWER SUPPLY

1 only Printed Circuit Board 86-9-3
1 only PL24/20 VA Transformer
4 only 2200uf 25 V RT Electrolytic Capacitors
1 only SO2 Bridge Rectifier
1 only 7812 TO-220 Voltage Regulator
1 only 7912 TO-220 Voltage Regulator
4 only ½" Spacers
4 only 1" x ⅛" Bolts
4 only ⅛" Nuts

GENERAL

1.5 metres Mains Cord
1 only 3 Pin Mains Plug
1 only Strain Relief Bush
10 metres Light duty Hook-up Wire
1 only DPDT Toggle Switch
19 only Printed Circuit Board Pins



For DTE devices set all lines in centre position, set CD line on both sides to +12 V, bridge TD to RD opposite side on both sides, bridge RTS to CTS opposite side on both sides, bridge DSR to DTR opposite side on both sides.

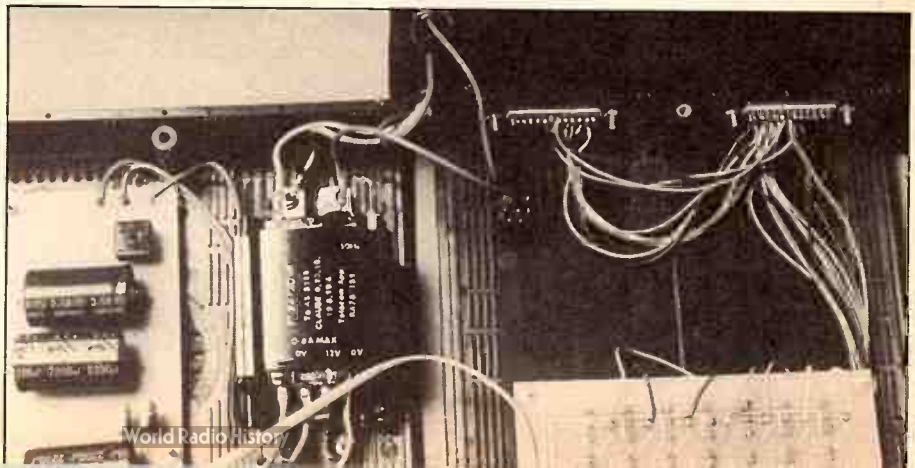
You may, if you wish, have this configuration permanently on a 14 pin header for future use.

These are only a few functions of BOB. BOB is a powerful unit for monitoring and changing signals at an RS-232-C interface. If care is exercised to avoid short-circuits, BOB can teach much about RS-232-C and help solve confusing problems.

Further reading:

"Beating the R232 Blues" G. Wideman, ETI, Aug, 1983, p84. ●

Kits of this project are available from All Electronic Components, 118-122 Lonsdale St, Melbourne Vic 3000. (03) 662 3506. Cost is $268.



ETI 613 MIDI INTERFACE FOR C64

Want to make your synthesiser perform better than you can play? Want to play a piece of music that would break your fingers if you tried to do it yourself? Then this low cost MIDI interface for the Commodore 64 could be the answer.

Mark Turnham

THE MUSICAL INSTRUMENT Digital Interface (MIDI) has been established for some time now as a standard format in the music industry for controlling synthesisers such as the Casio CZ series, the Yamaha DX series, the newer Roland models and many other brands of keyboard. One of the most powerful aspects of MIDI is that it enables a computer such as the Commodore 64 to be used with a MIDI interface for such purposes as a real time sequencer, a patch editor, a very complex step time sequencer, a music teaching aid, or even an intelligent stage lighting controller, controlled by a synthesiser keyboard (if you are willing to make that sort of effort!).

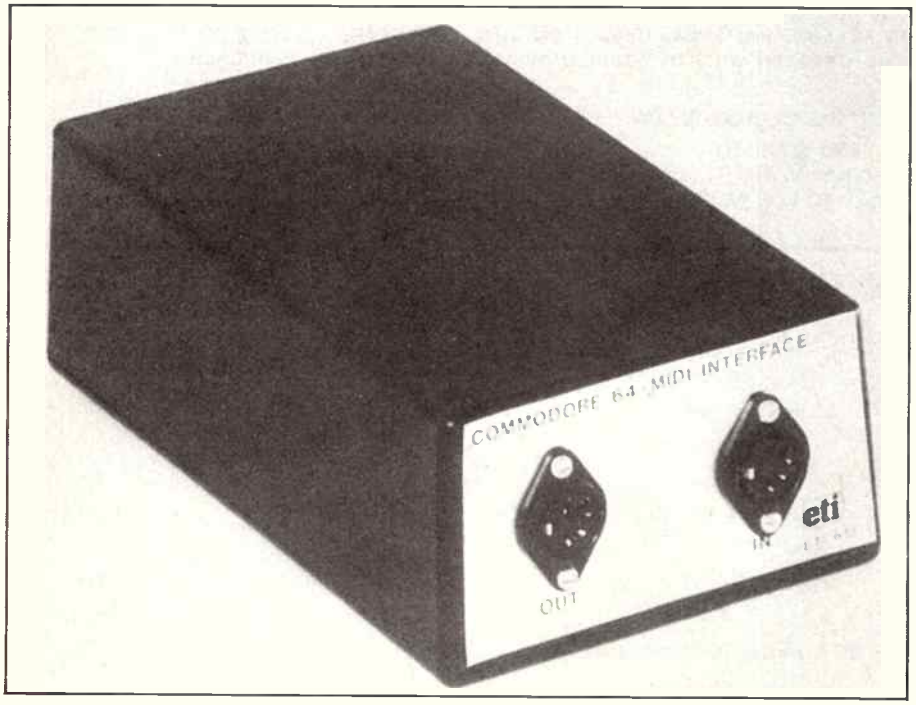
A detailed explanation of how MIDI works has already been published (ETI, October 1986, p18), and should answer most questions about the MIDI system. But in case you have forgotten . . .

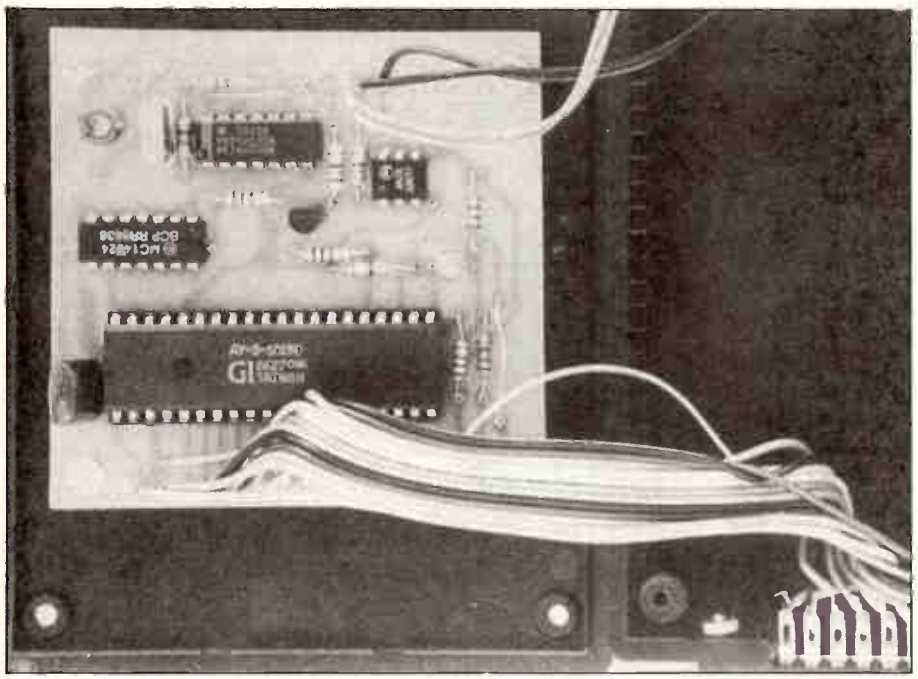
How MIDI works

MIDI information is always presented in serial format and always consists of eight data bits, one start bit and one or two stop bits.

This MIDI data is clocked at a rate of 31250 Khz ±1 per cent. The data is in asynchronous form, i.e. it has no sync pulse present on the data line between the MIDI transmitter and MIDI receiver. When MIDI data is transmitted it therefore only requires a two line connector (plus a shield against interference) for the information to be sent. On the transmitting side of a MIDI device a 0 V (low) or 5 V (high) signal is applied through the DIN connector which will control an optocoupler LED on the receiving device. This LED is coupled to the optocoupler's internal phototransistor which sends the MIDI information to the CPU of the receiving device. The reason that optocoupler are used instead of direct wiring is that it prevents digital noise and earth loops forming. A synthesiser receiving bad data in front of 100,000 people could cause a riot at some concerts!

The standard connector used for MIDI is the 5-pin DIN connector. Since MIDI





signals can only travel one way on a cable pair, two connections are required for two way MIDI communication, and this is found on most synthesisers as a DIN jack labelled OUT and another labelled IN. Sometimes a THRU jack is present which simply replicates the data entering the input jack and is used for daisy chaining. MIDI is therefore a very reliable system as there are no more connections involved than a standard audio or microphone cable.

One of the most common MIDI commands involves the turning on or off of a note on the keyboard. This is accomplished in three bytes. The first byte is the note control byte.

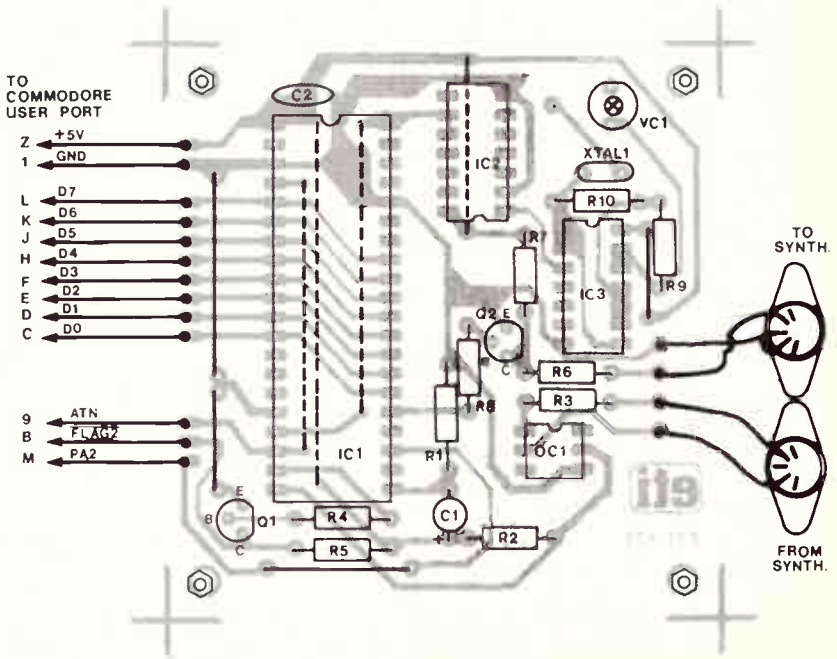
It tells the keyboard which channel the note is going to, and to turn the note on or off. The first byte (144+channel no.) turns the note on or (128+channel no.) turns the note off. The next byte is the note pitch byte (0-127), and the third byte is the attack/release velocity of the note played (0-127) which remains at a standard value of 64 for non-velocity sensitive keyboards such as the Casio CZ1000. The channel number defines which channel the note is being sent to. This enables up to 16 keyboards to be controlled simultaneously by a Commodore 64 using a MIDI interface.

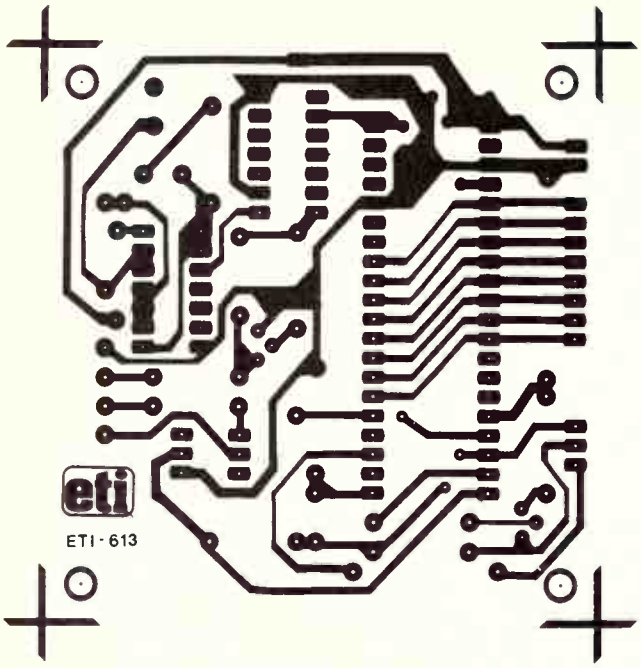
The MIDI channel number which the keyboard will accept is usually controlled by a pushbutton or slider on that particular keyboard. These three bytes of data are all you need to be able to program a very complex sequencer for the 64.

Design

The operation of this MIDI interface is quite straightforward with the UART chip doing most of the dirty work. The UART was chosen for this project as it can convert parallel data coming from the user port on the 64 into a serial data format acceptable for the MIDI standard. The UART is also capable of converting serial input data back into parallel form which can be read by the user port. Although the Commodore 64 has powerful serial interface capabilities it is not suitable for direct connection to MIDI as the baud rate for MIDI is far too high for the 64 to handle. Also, the C64 data is in asynchronous form, with a non-standard clock rate which can't easily be divided down to 31250 Hz. While the 64 could possibly handle MIDI using machine code with very precise timing in its programming, it would be a headache, even for an experienced programmer. This interface can be simply controlled and frees up the computer to do other tasks while the MIDI data is sent.

The output of the UART is inverted to drive the LED inside the keyboard's optocoupler via the DIN connector. The whole interface is clocked at 500 kHz (not 31250 kHz as the UART has an internal divide by 16 circuit). The clock is a standard type of crystal oscillator which runs at 4 MHz. At this speed it is better to use a faster TTL type IC or CMOS equivalent such as the 74HC00. The 4 MHz frequency is then divided to the required 500 kHz by a 4024 binary divider configured as a divide by 4 circuit. Although the 6N138 optocoupler is recommended as the best type to use for MIDI the 4N28 is






```
PROGRAM 1
READY.

10 REM MIDI OUTPUT TEST PROGRAM
20 POKE56578,PEEK(56578)OR4:POKE56579,255:REM SET UP USER PORT
30 O=12:CH=1:REM CH=CHANNEL NO.
40 POKE56577,144+(CH-1):POKE56576,195:POKE56576,199:REM TURN NOTE ON
50 POKE56577,N:POKE56576,195:POKE56576,199:REM SEND NOTE PITCH
60 POKE56577,64:POKE56576,195:POKE56576,199:REM SEND VELOCITY
70 FORT=1TO1000:NEXT:REM DELAY
80 POKE56577,128+(CH-1):POKE56576,195:POKE56576,199:REM TURN NOTE OFF
90 POKE56577,N:POKE56576,195:POKE56576,199:REM SEND NOTE PITCH
100 POKE56577,00:POKE56576,195:POKE56576,199:REM SEND VELOCITY
110 N=N+O: REM INCREMENT NOTE BY AN OCTAVE
120 IFN>120THENN=0:REM RECYCLE
130 GOTO40

READY.
```

```
PROGRAM 2

10 REM MIDI READER PROGRAM
20 D=4096
30 READT:IFT=-1THENEND
40 POKED,T:D=D+1:GOTO30
 100 DATA 173 , 2 , 221 , 9 , 8 , 141 , 2 , 221
 110 DATA 169 , 0 , 141 , 3 , 221 , 169 , 147 , 32
 120 DATA 210 , 255 , 169 , 0 , 141 , 32 , 208 , 141
 130 DATA 33 , 208 , 162 , 8 , 173 , 13 , 221 , 41
 140 DATA 16 , 201 , 16 , 208 , 247 , 173 , 0 , 221
 150 DATA 9 , 8 , 141 , 0 , 221 , 173 , 1 , 221
 160 DATA 141 , 167 , 2 , 173 , 0 , 221 , 41 , 247
 170 DATA 141 , 0 , 221 , 173 , 167 , 2 , 74 , 74
 180 DATA 74 , 74 , 157 , 168 , 2 , 173 , 167 , 2
 190 DATA 41 , 15 , 157 , 169 , 2 , 202 , 208 , 204
 200 DATA 162 , 8 , 169 , 32 , 32 , 210 , 255 , 189
 210 DATA 168 , 2 , 24 , 201 , 10 , 144 , 3 , 24
 220 DATA 105 , 7 , 24 , 105 , 48 , 32 , 210 , 255
 230 DATA 189 , 169 , 2 , 24 , 201 , 10 , 144 , 3
 240 DATA 24 , 105 , 7 , 24 , 105 , 48 , 32 , 210
 250 DATA 255 , 202 , 208 , 214 , 76 , 26 , 16 , 0
 260 DATA -1
```

quite adequate for this interface and is not likely to cause any problems. Also they are cheaper than 6N138s and are not as rare as hen's teeth.

The interface is connected to the user port lines PB0-PB7 for the reception and transmission of data. After the appropriate data is POKE'd onto the user port, the PA2 line is used to initiate the transmission of MIDI data to the keyboard. The FLAG2 line on the user port is pulled low by the UART whenever MIDI data arrives from the keyboard via the optocoupler OC1. Since MIDI data often comes in three or more bytes of data in succession when a note on a keyboard is played it is advisable to use machine code when reading MIDI data into the 64. As soon as the 64 senses the FLAG2 input (which can be used to trigger an interrupt) it should pull the ATN line high and the MIDI data will appear on the user port ready to be read in a simple parallel byte form by a PEEK command or its machine code equivalent. There are no external controls needed on this MIDI interface as it is entirely software driven.

Construction

Construction is quite straightforward and is unlikely to give any problems. Before constructing the circuit itself temporarily tape the board to the lid of the jiffy box and using the mounting holes as a template drill the four mounting holes in the lid. If you wish to mount the edge connector directly onto the box put the lid back on the box and place it, lid downwards, on a flat bench directly behind the user port of the Commodore computer. Then plug the edge connector into the user port and keeping the box flat on the bench move it sideways along the pins of the user port connector. This will leave a slight scratch on the box and will indicate the exact height at which the connector should be mounted. Now mark how wide the pins are on the conector and cut a slot big enough for the pins, allowing some space either side so the connector can be inserted when the connecting wires are soldered to it. When the connector fits neatly use it as a template to drill its mounting holes. Finally drill holes for the DIN connectors and their mounting bolts and the hardware part of the interface is finished.

After checking the PCB for cracks or any other horrible things, mount and solder all the links onto the board. Then solder the resistors onto the board. After that, solder the 100n capacitor onto the pads near pin 1 of IC1, and then solder the 2u2 tantulum making sure its orientation is correct. Next mount the variable capacitor. If it is a three-pin type it will only fit into the board the correct way, but if it is a small two-pin type, then one of the pins should be soldered to the vacant pad and a link connected from this to the pad leading to the crystal. Now solder the crystal onto the board. It doesn't matter which way it goes. If you don't feel confident about soldering a 40 pin IC, now is the time to solder in an IC socket, making sure that the notch indicating pin 1 is towards the top of the board. Next, making sure they are in the right way, solder in IC2 and IC3 and finally plug or solder in IC1. Now cutting to length a suitable piece of ribbon cable, solder the wires to the pads on the IC1 side of the board. Then pass these wires through the slot cut in the jiffy box, solder them to the appropriate pins on the user port connector and bolt the connector to the box. Finally solder the wires to the DIN connectors and mount them on the box.

Testing

After checking the wiring and component orientation a thousand times over,

PARTS LIST

Resistors	all ¼W, 5%
R1	3k9
R2, R5	1k5
R3	330R
R4	2k7
R6, R8	1k
R7	220R
R9, R10	470R
Capacitors	
C1	2µ2, 25V Tant.
C2	100n greencap
VC1	0-150µF Trim.
Semiconductors	
IC1	AY-3-1015D
IC2	CD 4024
IC3	74HC00
T1, T2	BC 547
OC1	4N28
Miscellaneous	
XTAL1	4MHz crystal
2 x 5-pin DIN jacks	
1commodore userport connector	
1 UB1 jiffy box (50 x 90 x 150mm)	
1 PCB	
nuts, bolts, ribbon cable, 6mm spacers etc.	

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plug the interface into the 64 and switch the computer on. If the monitor remains black or the computer powers up display a mass of horrible graphics, or if you smell smoke, switch off and check for the 1001th time for any shorts or wrong wiring, especially near the +5 V and 0 V pads on the PCB. If you have a frequency counter adjust the crystal oscillator to 4 MHz although the oscillator will usually work no matter how the variable is set. If everything is OK so far you will need to connect the keyboard to the interface via the DIN connectors and type in and save the two small test programs, progams 1 & 2. Now run program 1. Assuming that channel 0 is selected on the keyboard a note should sound from the keyboard which will go up one octave every second and eventually repeat this cycle over and over. If this works then run the second program and play some notes on the keyboard. The value of every byte of data sent to the 64 should be displayed in hexadecimal format on the screen. If the keyboard just sits there like a stunned cat, and you are sure that all the wiring is perfect, then IC1 may not be resetting correctly due to a leaky capacitor on pin 20. Try measuring the voltage at pin 20. If it is above about half a volt then lower the value of the 10 k resistor to about 3k9 or use a different capacitor. Just make sure pin 20 is below about 0.5 volts. If this doesn't work adjust the trimmer capacitor and the keyboard may just start playing notes. If it still doesn't work test if the oscillator is working.

If not, replace IC1 with another brand. If it is, see if IC2 is dividing correctly. If all else fails replace the UART. Note that some similar types of UART may use different logic levels for their programming of data formats so try and stick to the AY-1013D or change the programming pin logic levels (pins 35-39).

Programming

Here is the general format for making notes on the keyboard.

CH=Channel number

X=note number to be played

v=note playing velocity (default =64)

To turn a note on:

5 POKE56578, PEEK(56578)OR4: POKE56579,255 sets up user port registers.

10 PIKE56577,144+(CH—1): POKE56576,195: POKE56576,199; turn note ON.

20 POKE56577,X: note pitch value.

30 POKE56577,64: POKE56576,195: POKE56576,199; send note attack velocity value.

To turn a note off:

40 POKE56577,128+(CH—1): POKE56576,195: POKE 56576,199; turn note OFF.

50 POKE56577,X: POKE56576,195: POKE 56576,199; send note pitch value.

60 POKE56577,00: POKE56576,195: POKE56576,199; send note release velocity value.

Receving MIDI note data is a little more complex than this but involves these programming steps:

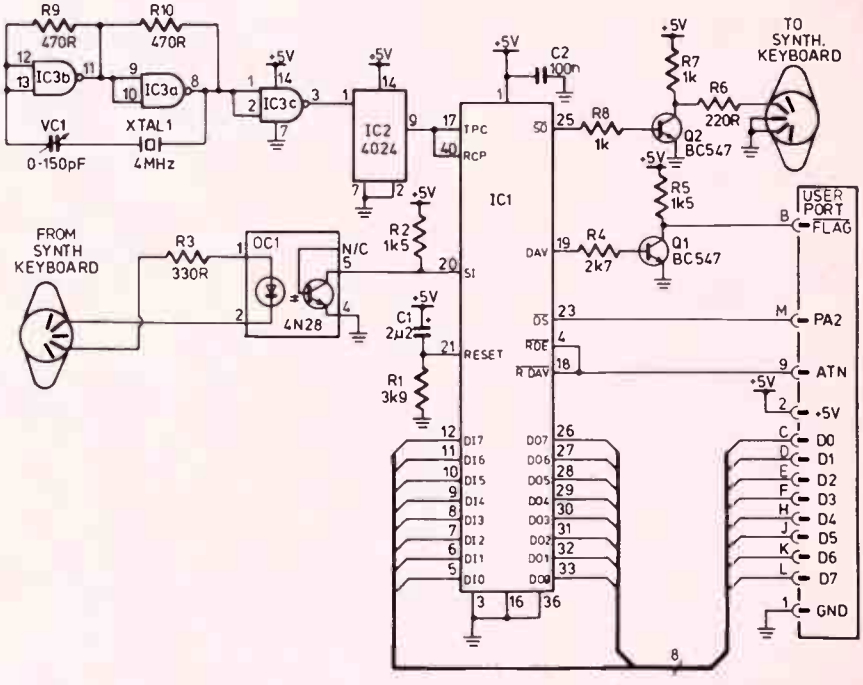
- Wait for the FLAG2 sensor on the user port to go low. (BIT 4 location 56589 will go 1 and can be made to trigger an interrupt).
- Make the ATN line high which will make the data appear on the user port. (BIT 3 of 56576).
- Read the data, process it, and wait for next FLAG.

Finally, while this interface was designed for the Commodore 64 there is no reason why it cannot be used on other computers with the appropriate output port connections. ●

ETI 613 — HOW IT WORKS

The heart of this circuit is IC1, an AY-3-1013D UART (Universal Asynchronous Receiver/Transmitter). When MIDI data is to be sent to the musical instrument, the PA2 pin on the 64 is brought low. This pin is connected to the Data Strobe pin (23) of IC1. The bit pattern on the data input pins of IC1 (pins 5-12) is then read by the UART and emerges in serial form out of pin 25 of IC1. A start bit and a stop bit are added to the data as per the MIDI requirement. This serial output is then inverted by Q2, R6 and R7 which will drive the optocoupler LED inside the keyboard under control via the DIN socket.

If MIDI data arrives from the keyboard at any time, then as soon as the data is detected at pin 20 of IC1 via the OC1 (the data is inverted by OCI and R2), IC1 will store it in an internal register and pin 19 will go high which pulls the FLAG input of the user port low via inverter Q1, R4 and R5. When the computer wants to read in the MIDI data, the ATN pin (9) on the user port goes low which pulls pin 4 (Read Data Enable) low which enables the output data pins (26 to 33) to be read by the user port. Also, pin 18 is pulled low which will reset an internal flip-flop whose output appears on pin 19 of IC1. Note that when the Read Data Enable pin is not low, the output data pins will be in a high impedance mode and won't interfere with input.



IC1 is clocked by IC2 and IC3. The clock oscillates at the crystal frequency of 4 MHz and is divided to 500 kHz of 31250 Hz. C1 and R1 are a simple reset network that provide a brief pulse when power is applied.

100 KBAUD CLONE LINK

We show you how to get at a 100 kbaud bi-directional communications link on your IBM type PC.

Peter Radcliff

DID YOU REALIZE that your IBM-PC has a communication link capable of working at speeds in excess of 100 kilobaud? It requires just a one wire modification to your IBM-PC and a little software. Furthermore the sending end requires no special software at all.

Before you start stripping your PC to find it I had better tell you it's the centronics printer port. It can both write and read data. The modification will not interfere with the port's ability to drive a normal printer. The modification is a very general purpose one that could be turned to many other applications.

A program called CENTRX and a cable will make a modified IBM-PC centronics port act like a printer receive port. Your IBM can be plugged into the centronics printer port of any computer and save the "printed" data to disk. I have used this approach for the fast transfer of many megabytes of files from my CP/M system to my IBM-PC. I have also transferred data from Apple-PCs, UNIX workstations and an IBM-PC to my portable IBM-PC.

The CENTRX program is too large to include in this article. I will gladly send you a copy of the source code and executable code on an IBM formatted 5¼" disk. The disk will contain:

CENTRX.PAS — Pascal source code of centronics receive program.

CENTRX.COM — Executable version of above.

CENTRX.PAS — As per CENTRX-.PAS but suits open collector drivers.

CENTRXOC.COM — Executable version of above.

XOR.PAS — Pascal source code to calculate XOR checksum of file.

XOR.COM — Executable version of above.

Please include $20 to cover the costs including the disk, postage and packing. Please address your letter to:
P. J. Radcliff, Lecturer, Dept Communications & Electronics Engineering, RMIT, PO Box 2476V, Melbourne 3001.

Running CP/M on a PC

Why transfer from CP/M systems to an IBM-PC? Firstly Wordstar 3.3 word processing files are compatible between CP/M and IBM-PC's. Even if your word processor doesn't have this level of compatibility, most of them can produce a simple ASCII document without any embedded control characters. In terms of speed and accuracy it is well worth transferring documents in this mode and adding word processing frills at the destination. Another good reason for transfer from CP/M to IBM-PC is that NEC makes a very clever microprocessor called the V20 which is essentially an 8088 microprocessor (for IBM-PC operation) AND an 8080 microprocessor (for CP/M operation) all in one chip! This means you can run most of your CP/M software on your IBM-PC. The exception to this are a few programs that require the Z80 instructions that the 8080 doesn't have. The V20 is pin compatible with the 8088 chip so you can simply remove the 8088 and plug in the V20. The V20 chip is available for about $15 and the CP/M shell for the IBM-PC is available for about $40 from several software suppliers. I have a large investment in CP/M software and I didn't lose it by moving to an IBM-PC because of the V20 chip.

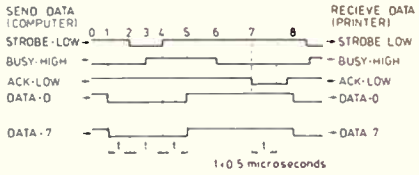
Centronics Interface

The centronics interface transfers parallel data at TTL voltage levels from a source device to a destination device, a one way transfer. It was specifically designed for a computer to drive a printer. It is fast, cheap to implement and reliable over distances of less than about three metres of cable. Nearly all personal computers use a centronics interface to drive a printer.

All practical communications systems have a *protocol* which is just a method of ensuring that data is correctly transferred from source to destination. Centronics is no exception, it controls the data flow using three handshaking lines called Busy, Strobe and Acknowledge. Handshaking lines are simply control lines between source and destination that make sure things happen in the right sequence. The waveforms shown in the box "Centronics Data Transfer Waveforms" show how one byte of data is transferred.

These modifications allow the Centronics data port to be bidirectional. This is a very versatile trick that could be applied to many tasks not just the high speed data transfer application presented in this article. The bidirectionality could be controlled by connecting say the pin "Pend" to the output pin "Init". A few thoughts for its use include driving hardware prototypes, digital to analogue convertors and data loggers.

Centronics Data Transfer Waveforms



Timer 0: Busy = LOW shows receiver reader for a new byte from the sender.
Time 1: The send ends put new data on the 8 data lines.
Time 2: The data is now stable 0.5 µs after it was asserted, strobe goes low to tell the receiver to latch in the new data.
Time 3: Busy goes high to say receiver busy processing the data.
Time 4: Strobe pulse returns to high again.
Time 5: Data is free to change values now, from 1 to 5 it must be stable.
Time 6: Busy goes low, the receiver is ready to accept more data.
Time 7: Acknowledge pulses low to acknowledge data received.
Time 8: Transfer cycle starts for next byte, step 1 again.

Data transfer needs at least the Strobe and Busy control lines to work properly. The Acknowledge control line may be required by some machines.

There are many other control lines on a centronics interface but they are not responsible for data transfer. They are used for the initialization, control and error indications for the printer. Check any parallel printer manual.

Modifying the port

The first step is to modify your IBM-PC centronics port. You will have at least one

if not two of these on your PC. The modifications will not interfere with the ports ability to drive a printer.

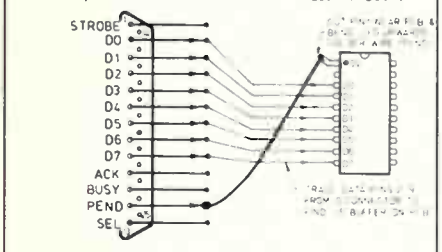
Most IBM-PC's and clones use an LS373 or LS374 buffer to drive the centronics data output port. However some PC's use open collector gates like the 7406 or 7407. If you have one of these you don't need to modify any hardware although the CENTRX program needs a small alteration as indicated later. The IBM-PC centronics printer interface reads back the data it has just put on the data lines to the printer. This is used to verify that the data lines to the printer are working properly and not shorted to zero volts or 5 volts. This read-back facility could be used to read in data from an external source if only the IBM-PC data drivers could be turned off.

The trick is to take the tristate control lines from the LS373 or LS374 buffer and control it from the centronics port. The tristate control lines can be used to turn off the IBM-PC data drivers. Data can then be driven from the other end of the cable and read from the IBM-PC data port. Thus we have turned the IBM-PC centronics transmit port into a centronics receive port.

In the case of the IBM-PC having open collector driver outputs a data port value of 0FF hex must be written forcing all outputs high. In this situation the other end of the cable is again free to write data to the cable which can be read from the IBM-PC centronics data read latch.

The box labelled "Making IBM-PC Centronics Bidirectional" shows the modification needed. To ensure the port will drive a printer properly the LS373/LS374 data driver tristate control line is connected to the PEND input from the printer end. PEND is usually used to indicate "paper out" and is sent from the printer to the computer. When paper is in the printer the pin is held low (0v), when it has run out PEND goes high (+5v). When a printer is connected to the modified port PEND is held low thus data will be sent from the LS373/LS374 to the printer as normal.

Making IBM-PC Centronics Bidirectional



Turn off your IBM-PC and remove the printer port board you wish to modify. The followed circuit shows how nearly all IBM-PCs and clones drive the centronics port by using an LS373 or LS374 8 bit latch. Note that if your IBM-PC uses open collector buffers like the 7406 or 7407 then no hardware modification is required though a small program modification is needed. The important LS373/LS374 chip can be found by tracing the pc board track from data pins 2-9 on the 25 pin female Cannon socket to the LS373/LS374 latch. The Canon connector is where the printer cable normally plugs in. Note that there will also be an 8 bit read buffer which is not a latch on these data lines, probably an LS240 or LS244. Do not confuse the two. The tristate control of the LS373 or LS374 (pin 1) must be cut and bent upward. A single wire is then soldered from there to PEND pin 12 on the centronics socket. This avoids any track cutting.

Timing

To use the centronics modifications for high speed data reception a program must be written to perform the receive handshaking procedure. The ideal situation is that the send computer need only the existing print commands.

There is one unfortunate problem — the short strobe pulse of 0.5 µs is too quick for a program to reliably detect. There are several solutions to this. One obvious one is to write a program for the send computer so it keeps strobe low for much longer, perhaps until busy goes high. In this case the normal print command on the send computer could not be used to transfer data. A better solution is to add a little hardware to the IBM-PC port to act as a pulse stretcher for the strobe pulse. This hardware and the cable details are shown in the box "Centronics Cable". This cable will be connected between your IBM-PC and the send end computer.

To see how the hardware captures a strobe pulse consider the case where the send end generated strobe is high: Q1 is turned on so its collector is low thus Q2 is turned off. Q1 collector drives the busy input at the send end thus the send end busy pin is forced low. If a low strobe pulse is generated by the send end then Q1 turns off and Q2 turns on forcing the base of Q1 low. Even when strobe returns high Q1 is held off because of Q2. The two transistors have acted as a flipflop to remember the strobe pulse.

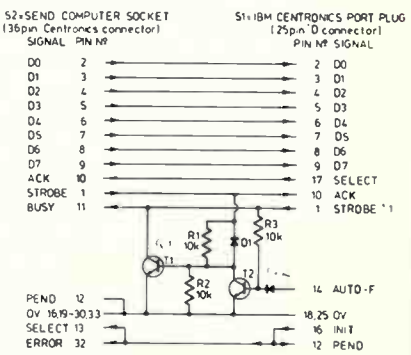
The IBM-PC receive program looks for a captured strobe pulse by reading the flipflop state via the IBM-PC (receive end) strobe which is a bidirectional pin. Receive data is then captured by reading from D0-D7 and the send end busy is returned to low (not busy) by using the IBM-PC strobe as an output. This strobe is pulsed low turning off Q2 thus returning the flipflop to its idle state which is Q1 collector and thus send end busy pin set to low.

The above caters for the strobe-busy handshaking. The acknowledge pin handshaking is done via the IBM-PC Select pin to send end Acknowledge pin link. The IBM-PC line "Init" is kept high thus keeping PEND High and turning off the IBM-PC data drivers. The IBM-PC program uses the Auto-Feed pin for testing the flipflop which provides a useful diagnostic tool.

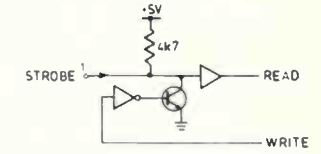
The purpose of D1 may not be readily apparent. It is required to ensure that Q1 will turn off fast when the send end strobe pulses low.

Most of the parts involved should be available from your junk box. The 7 components in the flipflop can all be fitted inside the cover of the 25 pin male cannon connector that plugs into the IBM-PC.

Centronics Receive Cable



***1 — The IBM-PC Strobe pin (and Auto-feed, Init, and Select) are bidirectional because they have an open collector driver. In the read mode the "write" (see below) must be +5v thus STROBE is pulled high by the 4.7 k resistor. Any other device connected to STROBE may write a +5v at no current drain or a 0V if it can sink 1 mA through the 4.7 k resistor. The STROBE pin is used for reading AND writing to the flipflop formed from Q1 & Q2.**



Strobe pulse stretcher

Using CENTRX

The program CENTRX that drives the IBM-PC centronics receive port is quite large — regrettably too large to print here. The entire source program can be obtained on disk from the address at the front of the article.

To run this program you must first modify your centronics port and then place the cable between the IBM-PC and the source computer. Insert a disk with the CENTRX program and type "CENTRX" then enter. The first thing the program does is to check the hardware is OK.

Three important things can be checked. Firstly it checks the port has been modified to work as a receiver. Secondly it checks the control lines from the send computer are in their expected state. Thirdly the program checks that the flip-flop works. This is done with the aid of the Auto-feed pin which when pulsed high has the same effect as the sending end strobe pulsing low. Error messages are printed to the screen if any of these fault conditions are detected and then the program aborts.

The sign of a good program is that it copes well with fault conditions. "Garbage in garbage out" is not a law of nature, just poor programming.

If your hardware checks out as OK then you will be asked for a file name to save information into. Beware if you specify a file name that already exists as the old one will be deleted. A message on the screen tells you to start. A counter of the number of bytes received should be seen incrementing on the screen. This is mostly to convince the user that the program hasn't gone to meet its maker. Unfortunately there is no way to tell if the send end has finished sending data. As per the prompt on the screen the user must press the space bar when the send end has finished. The program will then save its data to disk, print out the number of bytes received and the checksum of these bytes and finally return to the operating system. Files of any size may be transferred though there must be sufficient disk space for the received file.

At first glance it may seem a little crude that the human operator has to watch the source end finish then press the space bar. Remember however that there is no special program on the sending computer, merely the use of an existing "print" command.

The source computer print command can do odd things. If you use the CP/M command "PIP PRN:=Name" then the send is terminated if a Control-2 is found. This can result in only half an object code file being sent. To avoid this problem use the "O" option as in "PIP PRN:=Name[O]". Some print commands like PRINT on the IBM-PC add extra linefeeds to the end of a file thus altering the checksum value. No doubt other systems have similar joys lying in wait.

There is no error checking of the received data. I overcame this by using public domain Cyclic Redundancy Check programs (CRC check). A CRC check generates a number that is dependent on all the data in a file, if anything has changed then the CRC number will change also. On my CP/M system, I did a CRC check on each file which generated a four digit code. When I had transferred the files to my IBM-PC I did another CRC check. There was not one error in over 4 megabytes of transferred files.

A slightly simpler and faster checksum calculation is the basic exclusive-OR checksum. The checksum is calculated as a cumulative XOR, in pascal it would be written —

```
XOR Sum: = 0;
WHILE NOT EOF (File Variable)
BEGIN (It's not the end of file, keep on reading characters)
READ (File Variable, Ch); (Read the next character)
XOR_Sum: = XOR_Sum XOR ORD(Ch); (Update sum, ORD converts character to integer)
END;
WRITELN ('XOR checksum of file is', XOR_Sum).
```

I have included this simple and fast checksum into the CENTRX program. When the user causes the program to finish by pressing space bar, the checksum and number of bytes received is displayed on the screen. The disk of software offered at the end of this article includes a simple pascal program that will generate an XOR checksum on the send end computer. It is written to suit turbo pascal but should be easily modified to suit other pascal compilers.

CENTRX Speed

The speed of the data transfer usually seems to be limited by the speed of the sending end. I transferred data from my 4 MHz Z80 Big Board 2 to my IBM-PC with a disk to disk transfer rate of about 6 kilobaud (6000 bits per second). At first sight this may seem slower than transfer on a 9.6 kilobaud serial link but the serial communications programs that I have tried didn't get anywhere near 9.6 kilobaud. Typically the CP/M disk to IBM-PC disk transfer rate is around 1 kilobaud.

I did find one computer that this program did not work for, a UNIX work station. It relied on the printer initialization sequence being exactly what the centronics specification suggests. This is a rather silly idea that causes all kinds of problems not only for CENTRX. You can check if your computer has this problem. Power up the send end computer with the printer already on then unplug the printer cable and plug it back in again. If the computer refuses to send data to the printer you have this problem. Unfortunately there is not enough control port pins on the IBM-PC to perform both centronics receive and simulate the full initialization sequence.

CENTRX Details

The CENTRX program is written in turbo pascal though it should be easily modified for most pascal computers. A few sections of code that must be fast are written in assembler via the INLINE code facility.

The constants section defines the position of bits and ports on your IBM-PC. Check and if necessary modify the printer port address you wish to use from the alternatives given.

Two procedures: Got_Pr_Char and Ready_For_Nest_Char, completely handle the basic single byte transfer. The first procedure, Got_Pr_Char, simply checks the status of the two transistor latch by reading the IBM-PC Strobe bit. The Strobe bit is a bidirectional port, it can both read and write. If there has been no strobe pulse the procedure returns FALSE but if there has been a pulse then returns TRUE and saves the received byte of data.

The second procedure Ready_For_Next_Char is a critical procedure. It first pulses the Strobe pin low very quickly to reset the two transistor latch thus setting the send end Busy pin to low. The interrupts are turned off over this period to avoid unwanted delays. The procedure then sends a low pulse to the Acknowledge input pin of the send end. Together the Got_Pr_Char and Ready_For_Next_Char complete the basic single character transfer.

The procedure Pr_Port_OK checks the hardware is all OK. It is only called when the program starts. If anything is found wrong it prints an error message on the screen and returns a false condition so the calling program can abort back to the operating system. If your IBM-PC has open collector drivers you must make the small alteration indicated.

As per all good public domain programs, people will want to modify it. One possibility is to rewrite the whole thing in assembler to make it even faster. Another possibility is to include a true CRC calculation as well as the XOR checksum in the program. When the file is saved to disk its CRC could be displayed on the screen. A very useful modification would be to make the program find and use the address of the modified printer port. If you do alter CENTRX please keep the credits intact and send a copy to me! If you have the source of a good serial communications program you might try including the centronics port driver procedures as one of the configurations options. ●

Peter Radcliff is in the Department of Communications and Electronic Engineering at RMIT.

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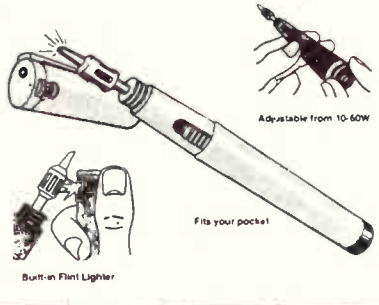

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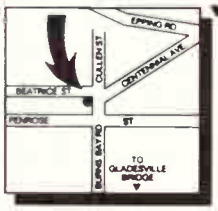

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OP AMPS: THE PRACTICAL WAY

Need a use for August's analogue breadboarding system? We present a potpourri of useful op amp circuits that are all tested and ready to go. Signal generators, a window comparator and some metering circuits are described which can be used to learn about op amps, or as a library of circuit ideas for your own applications.

PETER PHILLIPS

The circuits presented in this article are intended for construction on the breadboarding system presented in August, and are representative of the more useful circuits the op amp can be applied to. There is very little an op amp can't do, but space limitations make it impossible to cover everything. Selection of circuits was based on their cost, range of uses and suitability for testing with minimal equipment. Before presenting the circuits, first a brief look at some terminology and the more commonly used op amp types.

Terminology

The following terms are commonly used in manufacturers' data sheets, and an explanation also allows their use within the description of the circuits knowing a reference is provided.

Input differential voltage: An op amp has two inputs; the inverting and the non-inverting input, and the op amp amplifies the potential difference (or input differential) between these terminals. The maximum differential input allowed is usually equal to the supply voltage for the IC, typically 30 V for a 15 V dual supply.

Input Bias current: Any transistor-based op amp needs a small dc bias current (typically a few nano-amps) to flow into both inputs to bias the internal circuitry of the device. An equal resistance dc path from ground to each input is required for these currents.

Offset: Ideally, an op amp with zero differential input voltage should give a zero output voltage. Due to variations within the internal circuitry, this usually does not occur, and is compensated by applying dc offset to the inputs which is achieved by causing the dc bias conditions for each input to be slightly different. The maximum difference required is usually expressed as a voltage (input offset voltage) or a current value (input offset current). Some devices have offset null connections allowing an external adjustment to be applied, which should be made under no-signal conditions.

Drift: This is a measure of how the output voltage changes with temperature, important for precision applications, such as instrumentation amplifiers.

Slew Rate: The speed at which the output voltage of an op amp can change is called slew rate. If a square wave is applied to an op amp, a device with a low slew rate would probably produce a triangular wave at the output. Slew rate is measured in V/μs, and some devices (eg type uA715) feature slew rates of 100 Vμs, compared to the typical value of 0.5 Vμs for a 741.

Open Loop gain: This is the voltage gain of the actual op amp. If negative feedback is used, (as it normally is, except in comparator applications), the circuit gain becomes dependent on the feedback. A typical gain for an op amp is 200,000 and means that an output of 10 volts will result for an input differential voltage of 50 μV.

Closed Loop gain: When negative feedback is applied, the circuit (not the op amp) will have a gain determined by the amount of feedback. This figure is the closed loop gain, as a loop from output ot input has been provided by the feedback.

Frequency Response: Frequency response, or bandwidth, is the range of frequencies the circuit can amplify before the output falls to 0.7 (−3 db) of its normal value. All op amps can amplify dc, meaning the bandwidth is simply the highest frequency before the output falls by 3 db. A 741 has an open-loop bandwidth of 10 Hz, rising to 1 Mhz for a closed-loop gain of 1, showing that negative feedback increases the available bandwidth.

Common Mode rejection ratio: A common mode signal is one present equally on both inputs. This signal should not affect the output which should only respond to the input difference. The ability to reject the common mode signal is usually expressed in dBs. A high CMRR is −90 dB, which means a 1 volt common mode signal will appear as an output change of 31μV. CMRR figures vary from −10 dB up.

External frequency compensation: When negative feedback is applied around any amplifier, the possibility of instability, causing oscillation, can occur at specific gains. Using external capacitors to increase the stability of the circuit is known as frequency compensation. Some op amps are internally compensated; others provide terminals for the addition of the extra capacitors, allowing tailoring of the amp to the application.

Types Of Op Amps

Op amps are either FET devices (input only, or input/output) or transistor based. FET devices have a higher input impedance, and need lower input bias currents. Some common transistor based op amps are:

741: This IC is almost a standard, despite its relatively low performance. Its popularity comes from its ease of use, facilitated by the internal frequency compensation within the IC. However, because of the internal compensation, the characteristics of the 741 are fixed, limiting its use to general applications.

301: This op amp is pin compatible with the 741, but requires external frequency compensation, allowing it to be tailored to its application. However, more care must be taken in using it compared to the 741. Typically the 301 can have an improved slew rate, (up to 10 V/μs compared to 0.5 V/μs) and a lower output impedance (1 ohm versus 75 ohms).

747: A dual 741 with (in the 14 pin version only) offset null terminals for both amplifiers.

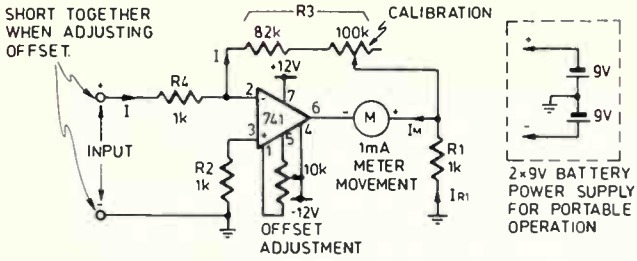

Figure 1: AμA meter

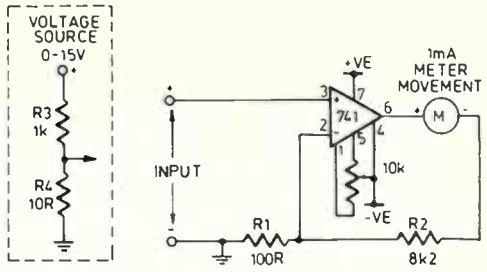

Figure 2: AmV meter

348: A quad 741 in the one 14 pin package with no facility for offset adjustment.
324: A quad op amp designed to operate with a single or a dual polarity supply. Single supply operation is possible with all op amps by using input biasing techniques, but the 324 is designed to allow conventional circuit configurations with a single supply rail as low as 3 V.
709: Similar to the 301, but with different external frequency compensation arrangement. Pin compatible to the 741.
1458: Dual op amp in an 8 pin package.

The following are the more common FET devices.
TL-071/uA771: FET input, pin compatible to 741, offset terminals, single op amp in 8 pin package.
TL-072/uA772: FET input, pin compatible to 324, quad device in 14 pin DIL package.
CA3130: MOSFET input RCA device, 8 pin DIL package.
CA3140: MOSFET input, similar to above.

OP Amp Metering Circuits

An op amp can be used with relatively low sensitivity meter movement to measure small currents or voltages. The input impedance of a voltmeter circuit can be very high, or made very low for an ammeter circuit. Measuring ac voltages at frequencies covering the audio range is possible with the addition of a diode bridge to the basic dc voltmeter circuit. All the following circuits allow range changing by switching one resistor value, and a complete multimeter could be constructed by adding suitable switches. All circuits require a dual polarity power supply, and for portable operation, two 9 V batteries could be used, as the current consumption is in the order of 5 milliamps.

A dc μA meter

The circuit of figure 1 uses a 1mA meter movement that shows full scale when measuring a current of 1uA, and range chaning is achieved by altering the value of R3. The circuit operation is as follows:

The current being measured (I) will flow in R3 as the op amp inverting input is a virtual open-circuit. The voltage at both inputs to the op amp will be equal, as the negative feedback around the op amp causes a zero differential input voltage. The non-inverting input is connected to ground with R2, and as no current flows in this resistor, the voltage at the non-inverting, and therefore the inverting input, is 0V. To create the current I in R3, the op amp must send its output negative. This voltage will cause the required current in R3, and another in R1 as a result. The meter current (I_M) is the sum of both currents, and the ratio of P3 to R1 therefore determines the value of I_M. Using the equations shown with the circuit. Full scale deflection for a current (I) of 1uA, with a 1mA meter movement and R1 at 1k, establishes R3 at 999I. If full scale deflection is required for 10uA, change R3 to 99k. By using the nearest preferred value resistor in series with a variable resistor, calibration can be achieved. Offset should be adjusted for zero deflection on the meter with a short-circuit applied across the input terminals as shown. The test current (I) can be from any external source, providing no conflict occurs due to multiple earths. Isolating either the external source or the ammeter circuit from earth will prevent this possibility.

A dc mV meter

The circuit of figure 2 gives full scale for an input voltage of 100 mV, and range changing is achieved by selection of the value of R1. The input impedance is very high, depending mainly on the characteristics of the op amp. The operation again assumes that the input differential voltage is maintained at zero by the op amp. A positive dc voltage applied to the non-inverting input will cause the op amp's output to become positive, creating a current in R1. This current, which flows through the meter movement, will be a value that establishes a voltage across R1 equal to the input voltage. The value of R1 is therefore determined by dividing the voltage required to register full scale with the FSD current of the meter movement being used.

For a 100 mV voltmeter using 1mA meter movement, R1 is 100 ohms. A value of 10 ohms allows full scale at 10 mV; 1k, 10k, etc for 1 V, 10 V and so on. Offset should be adjusted with the input terminals shorted together. The value of R2 is not important, and can even be deleted. However, its inclusion protects the meter movement by limiting the worst case current to a suitable value. The circuit comprising R3 and R4 connected to a variable power supply will produce test voltages in the mV range, allowing calibration against a reference millivoltmeter.

An ac/dc mV meter

The circuit of figure 3 uses a 301 op amp, as the 741 is not suitable if a frequency response covering the audio range is required. The basic configuration, and operation, is the same as figure 2, except a diode bridge is included around the meter movement. Also, the addition of a compensation capacitor is required, and the offset adjustment circuitry is different. The addition of the diode bridge provides steering of the op amp output current so that uni-directional current flows in the meter movement. The voltage drop across the diodes is compensated for by the op amp, and hence the value of R1 is calculated as for Figure 2. The meter will always register up-scale regardless of the polarity of the input voltage, and permits measurement of ac as well as dc inputs. The test circuit demonstrated a flat frequency response to 100 kHz: well beyond audio range. Note that the resistor R2 used in figure 2 is deleted, as its inclusion compromises the frequency response. However, caution is required, as worst

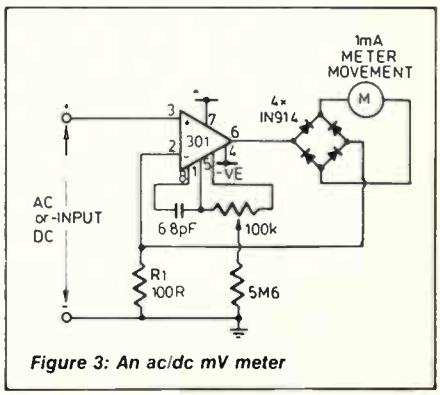

Figure 3: An ac/dc mV meter

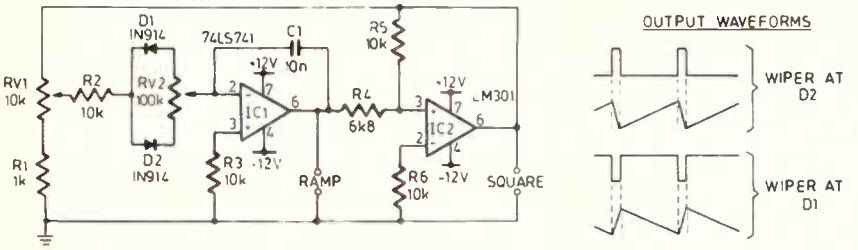

Figure 4: A variable slope triangular/square wave generator

case currents of 10mA or more can flow through the meter movement. The value of R1 would need to be altered from its dc determined value if RMS and/or peak readings were required. This should be done by comparing the displayed voltage values to a measuring reference such as a CRO.

Waveform Generators

Sine, square and triangular waveforms can be generated with relatively simple circuitry using op amps. A 3-in-1 circuit is possible, but the simplest method is to use one circuit for the sine wave, and another for the triangular-square waves. Synthesis of a sine wave from a triangular wave is one method if a 3-in-1 circuit is required, and many function generator ICs operate this way.

A Variable Slope Triangular-Square Wave Generator

Figure 4 shows the circuit of a triangular-square wave generator with variable frequency and variable slope capabilities. The circuit comprises IC2 connected as a Schmitt trigger operated by IC1 which is wired as an integrator. The output of IC2 will be either maximum positive or maximum negative, depending on the input voltage applied by IC1. If IC2 has a positive output, C1 will be charged by a constant current at a rate determined by the values of RV1, R1, RV2 and C1, causing the output of IC1 to ramp linearly in a negative direction. When the ramp reaches a point established by R4 and R5, the Schmitt trigger will switch to the opposite polarity, reversing the direction of the ramp, and the cycle then repeats in the opposite direction.

RV1 varies the frequency over a decade range, and RV2 determines the slope of the ramp for each half cycle. If RV2 is wound towards D2, less resistance for the positive charge path, and a higher resistance for the negative charge path is created. Because IC1 is connected to the inverting input, the negative ramp will be of a shorter druation, and the positive ramp will be longer compared to the ramp times with with RV1 set to its central position. The setting of RV2 will affect the frequency by around 15%, and give the waveform variations shown on the circuit diagram. The sounds produced by a variable-slope triangular wave are worth an audition, and when mixed with other waveforms can be most unusual. A 301 op amp is specified for IC2, as the poor slew rate characteristics of the 741 make it unsuitable for square wave generation. Changing the value of C1 by a factor of 10 will allow another decade of frequencies.

A Sine Wave Oscillator

Figure 5 is a Wien bridge oscillator that will provide (for a 12 V dual supply) a 1 kHz, 15 V p-p sine wave. The critical aspect of any sine wave oscillator is the negative feedback, which needs a dynamic control element within the loop to maintain a steady output level, free of clipping. Usually a glass encapsulated, negative temperature coefficient thermistor is used, although, with correct selection of components, a 12 V low current light globe can be employed. A characteristic of any thermistor, is the thermal inertia of the device, which will cause waveform 'bounce' when any electrical disturbance occurs.

The dynamic element in Figure 5 is the inverse parallel diode combination. This arrangement is not as good as a thermistor, and some distortion will be evident in the output. However, by adjusting RV1 appropriately, reasonable results can be obtained. This circuit is an easy means of obtaining a reasonable quality sinewave, and the frequency can be changed by altering the values of either C1 and C2, or R1 and R2.

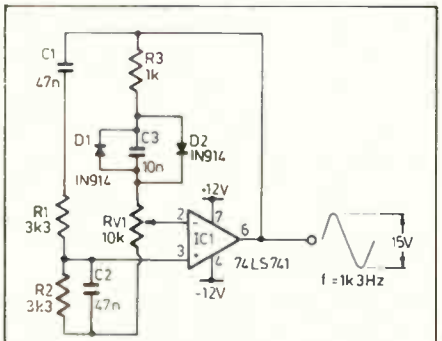

Figure 5: A sine wave oscillator

A Window Comparator

A window comparator is a circuit that provides an indication if an input voltage is between two limits; ie, within the window. Output indication showing that the input lies within the window can be used, or, if desired, up to three indicators showing higher than, within and lower than the window. In its simplest form, a window comparator is merely two comparators with the outputs ANDed to operate the indicator. Two reference voltages are required, and both comparators will go to maximum positive only when the input test voltage lies between the two references. Figure 6 shows a window comparator/reference voltage generator circuit, built around a 324 quad or amp. Three LED indicators are used, and a single variable reference voltage will generate both the upper and lower reference voltages. The suggested application is categorising Zener diodes into three voltage groups; less than 4 V, between 4 V and 8 V, and greater than 8 V.

Op amps IC1a and IC1b, with resistors R3 to R9 comprise the reference generator, producing an output of $V_2 + V_1$ at pin 7, and $V_1 - V_1$ at pin 1. For the suggested application, V_2 is set to 6 V by R1 and R2, and RV1 is the variable V_1, set to 2 V. Assuming these values, operation is as follows:

1. Voltage at pin 3 = V_2 divided by 3 (=3V), as R5=R6.
2. Because IC1a has negative feedback, the op amp will have a zero differential input voltage, and the voltage at pin 2 will also equal 3V, causing a 1 V drop across R3, (V_1 — 3V).
3. The current in R3 equals that in R4, as none flows into the op amp's input terminimal, giving 1 V across R4, as R3 = R4.
4. To create 1 V across R4, with the correct polarity, the voltage at the output (pin 1) must be +4 V, which satisfies the equation $V_2 - V_1$.
5. The voltage at pin 5 equals V_2 (6 V) as no current (except the op amp's bias current) flows in R9, (R9 equals the combined parallel value of R7 and R8

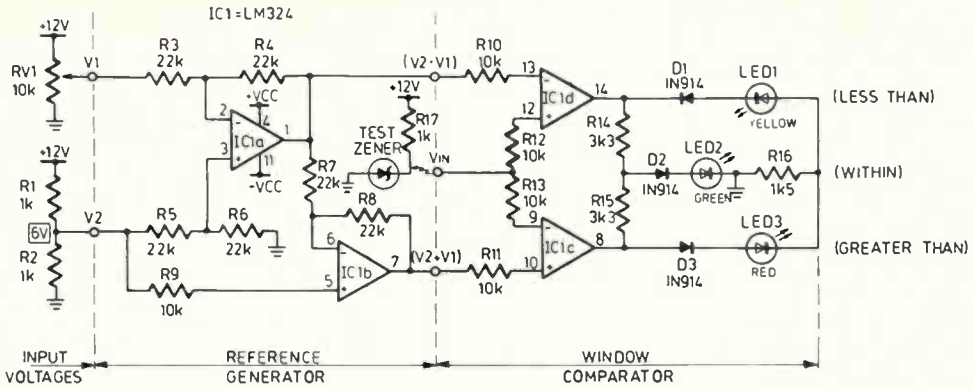

Figure 6: A window comparator with a reference generator

to minimise offset at the output).

6. The voltage at pin 6 equals 6 V (for the same reason as in 2), giving a 2 V drop across R7.
7. The voltage across R8 equals 2 V (as in 3).
8. The output voltage at pin 7 equals 8 V; the sum of V_2 and V_1.

Op amps IC1c and IC1d, connected as comparators, make up the window comparator. The test input voltage (V_{in}) is applied to each comparator, and is compared to the reference input voltages generated by IC1a and IC1b. The output of IC1c is maximum negative when V_{in} is less than 4 V; otherwise maximum positive. The output of IC1d is maximum negative when V_{in} is higher than 8 V; otherwise positive.

The output indicator circuit has three LEDs, protected against reverse breakdown by diodes D_1 to D_3. LED_1 lights when A3 has a negative output, showing V_{in} less than 4 V and LED3 lights when V_{in} exceeds 8 V. LED_2 is on when both IC1c and IC1d are positive, (V_{in} within the window), as a negative output at either IC1c or IC1d causes the voltage across LED3 to fall to around 0 V. The resistors R14, R15 adn R16 are chosen to limit the LED current to 10mA; protecting the op amp outputs. ●

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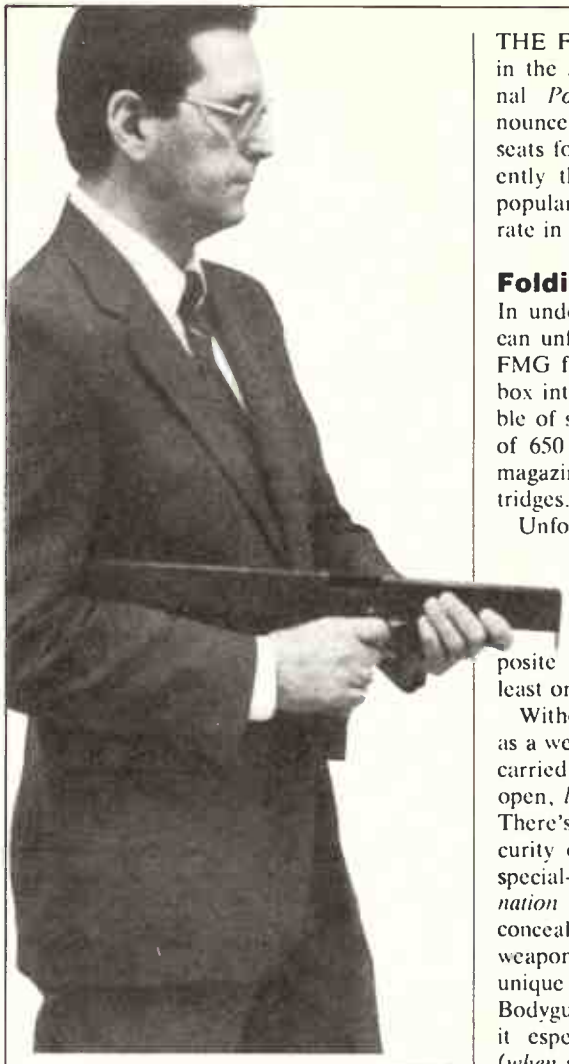

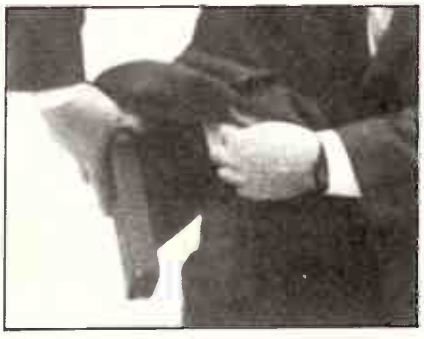

THE FOLLOWING ARTICLE appeared in the July edition of the American journal *Popular Science* among other announcements concerning new types of car seats for babies and Mexican cars. Apparently the editors considered the FMG a popular item. One wonders how it will rate in Hungerford or Clifton Hill.

Folding machine gun

In under three seconds an expert shooter can unfold the self-contained ARES 9mm FMG from an innocent looking flat black box into a compact submachine gun capable of spitting out bullets at the cycle rate of 650 rounds per minute *(WOW!)*. The magazine capacity is either 20 or 32 cartridges.

Unfolded, the 9mm FMG is 19.8 inches long. Folded, it measures only 1.4 by 3.3 by 10.3 inches. Although the current prototype weighs about five pounds, composite materials are expected to shave at least one pound off this figure (*great!*).

Without a chance of its being detected as a weapon, the folded 9mm FMG can be carried in your hand, right out in the open, *like a Melbourne street for example.* There's a need by undercover lawmen, security officers, *lunatics, gun fanatics*, and special-assignment military forces (*assassination squads*), worldwide for a readily concealable, high-firepower automatic weapon. It is this requirement that the unique 9mm FMG was designed to fill. Bodyguards of heads of state should find it especially well adapted to their use (*when shooting the subjects of the heads of states*). These agents' guns must not be apparent to the public — for the sake of their distinguished clients' images — but they need more firepower than any handgun can deliver, in an automatic weapon less cumbersome than the typical machine pistol or sub-machine gun now used for such duty.

Francis Warin, senior engineer at ARES, Inc., of Port Clinton, Ohio, is the inventor of this high-tech submachine gun. It is currently under development by ARES, which is headed by Eugene Stoner, famed designer of the US M-16 rifle.

Because ARES is strictly in the research and development business, another firm will manufacturer the 9mm FMG when R&D work on the gun is completed. Sales, of course, will be restricted to military and law-enforcement purchasers. This is not a consumer product *yet.*

— Paul Wahl

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5. Description of the competition and instructions on how to enter and conditions of entry form part of the competition conditions.
6. The competition commences on September 1 and closes on last mail December 31st. The draw will take place in Sydney on January 18th, 1988, and the winner will be notified by telephone and letter. The winner will also be announced in the Australian on January 25th and a later issue of this magazine.
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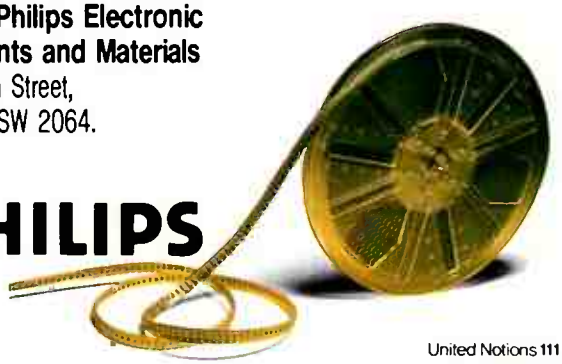

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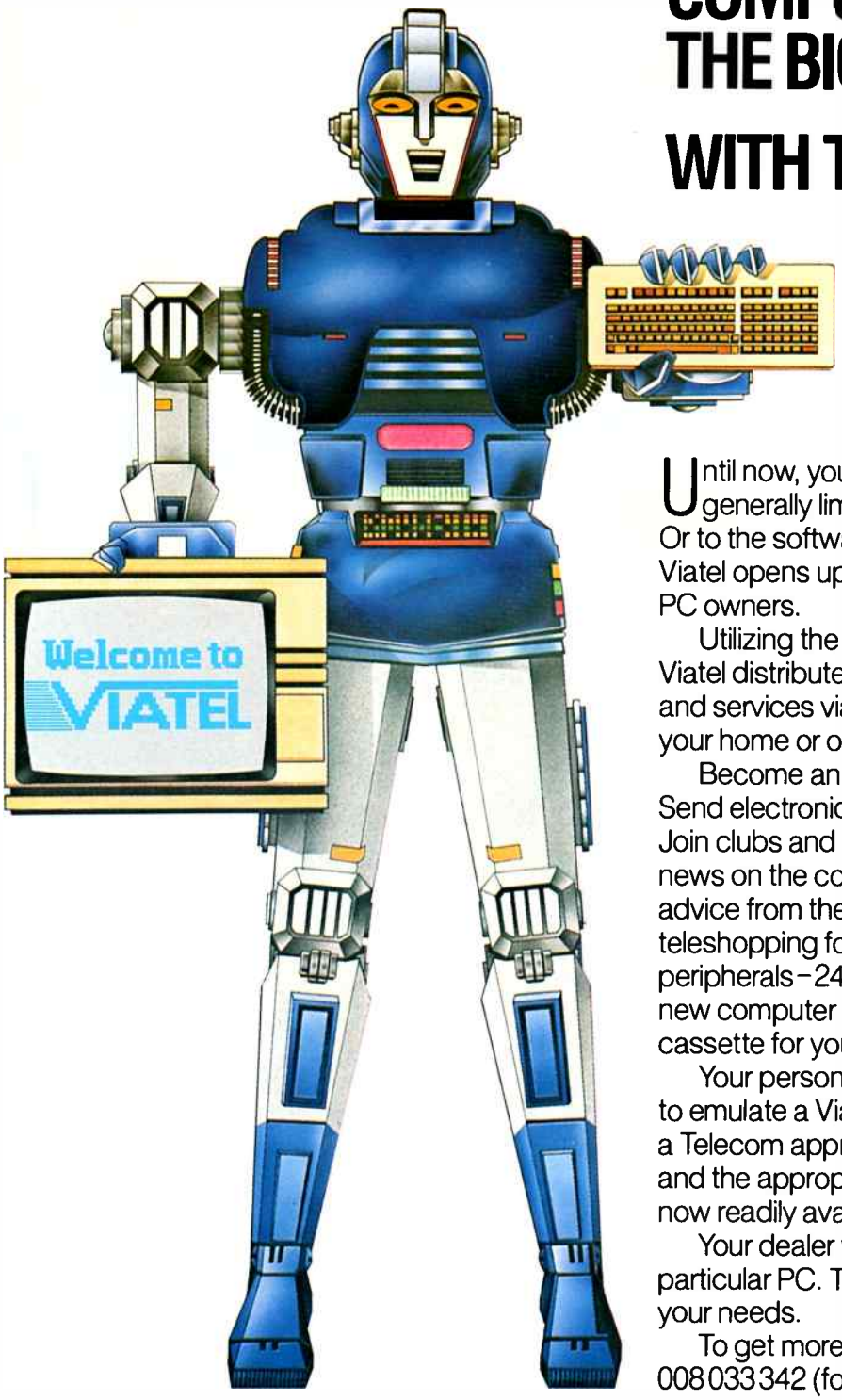

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